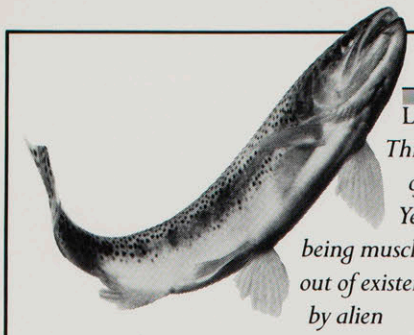
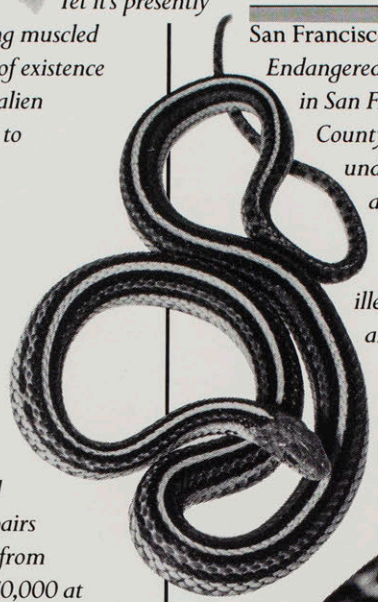
TERRA

THE NATURAL HISTORY
MUSEUM OF
LOS ANGELES COUNTY

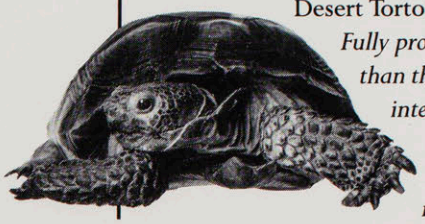
VOLUME 29, NO. 2–3
WINTER 1990/SPRING 1991



Little Kern Golden Trout. *Threatened. A survivor of the ice age. Yet it's presently being muscled out of existence by alien rainbow trout introduced to its habitat by man.*



San Francisco Garter Snake. *Endangered. Extinct in San Francisco County. Hunts underwater and can live up to 10 years. Threatened by illegal collection and loss of wetlands to urban development.*



Desert Tortoise. *Fully protected. Older than the pyramids, very intelligent and California's official state reptile. Careless land use, illegal collecting and off road vehicles are a constant threat.*

California Yellow Billed Cuckoo. *Endangered. Because of the destruction of riparian forests in central California, mating pairs have dwindled from 70,000 at the turn of the century to just 60 pairs today.*

Blunt Nosed Leopard Lizard. *Endangered. Due to encroachment near Bakersfield and in the San Joaquin Valley, only 5% of its habitat remains.*

Great Grey Owl. *Rare. Less than 60 occur in California in the Yosemite National Park area. One of the many species that relies on the protection of public lands.*

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Due to circumstances beyond their control, 34 species native to California have been lost to extinction. Gone forever.

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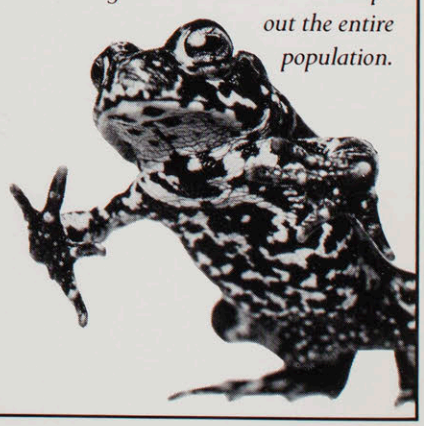
Black Toad. *Threatened. Found only in one high desert valley near Bishop, California. Bizarre coloration attracts illegal collectors. Even the slightest change of its small habitat could wipe out the entire population.*



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TERRA

THE MEMBERS' MAGAZINE
OF THE
NATURAL HISTORY MUSEUM
OF LOS ANGELES COUNTY

VOLUME 29, NO. 2-3
DECEMBER 1990 –
MAY 1991

COVER: Man's shirt, Tanaina. Tanned caribou or moose skin with trim of otter fur and sewn and loom-woven quillwork. The attractive pale color of the costumes in the Etholen collection is due to the fact that the skins were allowed to freeze during the treatment process. Etholen collection, a donation of 1846; courtesy Finnish National Board of Antiquities. Photograph by Matti Huuhka. See page 18.

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MEMBER FDIC

MUSEUM ON THE MOVE

DEVELOPMENT

SUPPORT FOR PUBLIC PROGRAMS. In recent months the Natural History Museum has received funding for its exhibitions and educational programs from several sources.

The ARCO Foundation, a major supporter of exhibitions at the museum, provided a generous gift to sponsor the national tour of Gifts from the Great Land. Museum Governors, Trustees, and Alliance Board members honored ARCO at a special reception with the Finnish Ambassador preceding the opening gala for the exhibit. The New York Times sponsored the gala and patrons' openings, and Nordstrom provided additional local funding.

Metropolitan Life Insurance Company sponsored Snoopy: Good Grief! He's 40!, and Determined Productions provided a memorable birthday extravaganza, complete with root-beer floats and Charles Schulz himself.

Texaco will sponsor the exhibit Court Arts of Indonesia, which travels to the Natural History Museum in fall 1991.

The Natural History Museum received a generous grant of $31,000 from Transamerica Life Companies for publication of a book in conjunction with the museum's traveling exhibition, Sharks: Fact and Fantasy. Copies of *Sharks: Fact and Fantasy* are being distributed to educators through the museums in the U.S. and Canada that are hosts to the traveling exhibit; the book is also available through the museum stores.

A major grant from the Confidence Foundation will support a teachers' workshop focused on the museum's new bird hall this spring. Other educational programs have received support from the Brotman Foundation, the Leavey Foundation, the Roth Family Foundation, Associated Foundations, Great Western Bank, and Dr. and Mrs. Henry Nesburn.

■

NEW BUSINESS ASSOCIATES AND FELLOWS. The museum is pleased to have the following corporate leaders as new members of its **Business Associates:**

California Business Magazine
Carsey Warner Company
Farmers Insurance Group of Companies
J. T. Nakaoka Associates Architects
Petersen Publishing

The **Fellows** enjoyed an adventure in Africa this summer and started the fall Fellows season with a special reception closing the exhibition Sharks: Fact and Fantasy. Africa remained a theme, as the Fellows enjoyed memorable dinners with Mary Leakey and with photographers Angela Fisher and Carol Beckwith. They also explored the studio of gem photographers Erica and Harold Van Pelt, the fossils of Marble Mountain, and the intricacies of sailing a tall ship. For Halloween, the Fellows took a course in pumpkin carving from Jim Olson, Chief of the museum's Exhibitions Division.

The museum welcomes our newest Fellows, who joined between July 1, 1990, and January 22, 1991:

Patricia and Richard Anawalt
Christopher K. Arnold
Bill and Shirley Bottger
Sharon Brewster and Bob Vanderet
Susan M. Carter
Judith Cooper
Martin and Cheryl Cooper
Mr. Charles Ducommun
Robert J. Farina
Mr. & Mrs. Charles L. Frandson
Mr. and Mrs. Thomas Hacking
Dr. Johnny R. Harrison
Mary Kay and Boyd Hight
Christopher and Diana Houser
Michael and Virginia Kazanjian
Wayne C. Leicht
Particia Lombard
Ms. Donna M. Matson
Sally McDonald
Judith Morse
Peter and Juli Robinson
Jack, Becky, and Matthew Rodman
Charles Rosenberg
Dr. and Mrs. James Royer
Ms. S. Shilliday and Mr. M. Herskovitz
Mr. Robert Sutton
Maurine Taubman
Mr. and Mrs. Harry Tytle
Mr. and Mrs. Philip Wexler and Family

■

SYSTEMATICS LABORATORY RECEIVES NATIONAL SCIENCE FOUNDATION GRANT. The Natural History Museum is moving into the twenty-first century with the development of a new facility for using modern techniques of analyzing genetic and evolutionary relationships among organisms. The museum currently has a biochemical systematics laboratory where proteins are studied. In the new Biochemical and Molecular Systematics Laboratory, museum scientists will be able to study genetic material (DNA) directly, giving them even more detailed information on the biology of plants and animals. This information will be used in a variety of ways, such as in reconstructing the history of a species or determining the conservation status of an endangered population.

Dr. Sarah B. George, Associate Curator in the Mammalogy Section, and Dr. Joel W. Martin, Associate Curator in the Invertebrate Zoology Section, have received a grant for $54,000 from the National Science Foundation to purchase major pieces of equipment, such as centrifuges, an ultra-cold freezer (below -70° C), and a thermocycler for making multiple copies of DNA from museum specimens. Drs. George and Martin, and Dr. Daniel M. Cohen, Chief Curator of Life Sciences, are working with the Development Office to secure funding needed for construction and endowment of the new facility.

■

NATIONAL SCIENCE FOUNDATION SUPPORTS MAMMALOGY COLLECTION. Dr. Sarah B. George, Associate Curator, and Dr. John E. Heyning, Assistant Curator and Section Head of Mammalogy, have received a grant totaling $306,633 from the National Science Foundation for three years of support for the museum's mammal collection, which is the ninth largest in North America (its marine mammal component is the second largest in the world).

The mammal collection is used in a number of studies of the biology of mammals, such as investigations of the evolution of whales, the genetic variability of small mammals in southern California, the diets of whales in the eastern Pacific Ocean, the anatomy of the big cats, and the parasites of Costa Rican mammals.

Two new curatorial assistants have been hired to help with preparing and cataloging mammal specimens; one assistant works with the mammal collection at the Exposition Park facility and the second with the collection at the Marine Mammal Laboratory in Vernon. Additional funds will be used for a visiting curator program and for the purchase of specimen cases and supplies for conserving specimens.

■

AMERICAN INDIAN FESTIVAL AND MARKET ENLARGED. The 19th Annual American Indian Festival and Market will be held March 22, 23, and 24 and will be the largest ever organized by the museum. The number of artists who will discuss and sell their work at the festival has been increased from 24 to over 40. The festival is the only event on the West Coast that brings together so many of the top names in American Indian art. This year's festival is sponsored by United States Borax and Chemical Corporation.

EXHIBITIONS

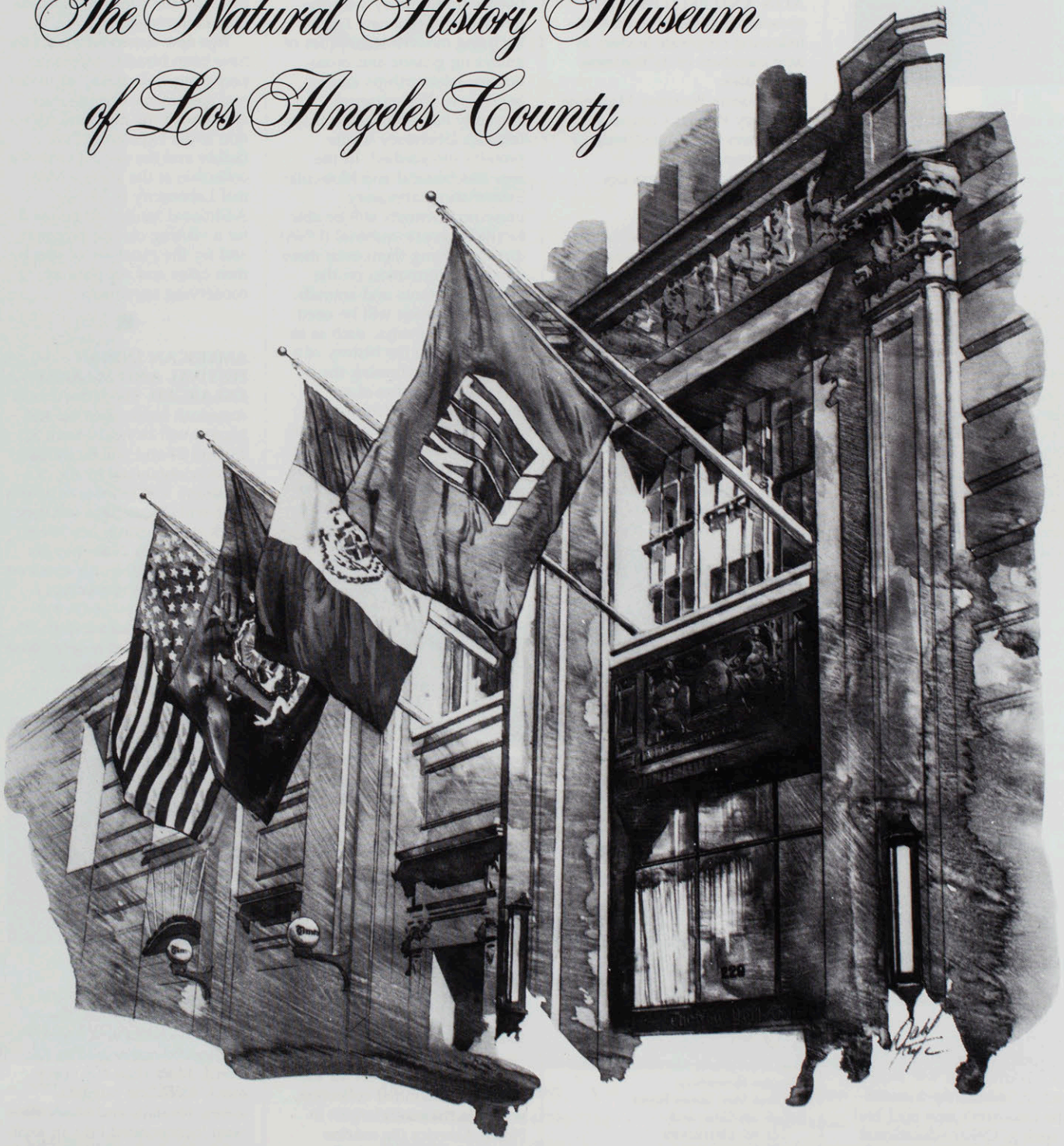
GOLD EXHIBIT REMODELED. The Natural History Museum now boasts one of the finest and largest displays of native gold in the world. More than 400 specimens, including nuggets, leaves, crystals, and wires, have been incorporated into an exciting permanent public display in the Hall of Gems and Minerals; the total weight of the gold on exhibit exceeds 135 kilograms

Continued on p. 7

The New York Times

Salutes

The Natural History Museum of Los Angeles County



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Not available in some areas.

(300 pounds). In addition to exploring the natural history of gold, the exhibit reveals the natural beauty of the element and its tremendous importance in human culture.

Funding for the installation of the new exhibit was provided by the museum's Gem and Mineral Council and by the World Gold Council. Donald R. Dickey and Dr. Giles W. Mead donated many important gold specimens, and Robert E. Petersen and the government of Sierra County, California, made long-term loans of major gold nugget collections. The exhibit is dedicated to Florence V. V. Dickey (1881-1974), a pioneering woman miner and naturalist.

A MEMORIAL

GEORGE V. CALDWELL (1914-1990). The Natural History Museum has lost a great friend and benefactor. George V. Caldwell died in October 1990, a few months before completion of the project that occupied his time and energy for over 5 years. At the opening of the Ralph W. Schreiber Hall of Birds in January 1991, there was a special toast to George, whose powers of persuasion attracted many supporters for this new environmental hall.

George grew up in the Bridger Valley of Wyoming, where he developed a love of adventure and the outdoors that colored the rest of his life. He broke and trained wild horses for the U.S. Army's Horse Drawn Field Artillery in the early 1940s, traveled the world with the Army's Transportation Corps, and retired from active duty as a Major to start an import/export business. He was a business leader in the field of microelectronics, forming Microlectron in Los Angeles in the 1960s.

In Phila McFie, George found an enthusiastic partner for life. The Caldwells traveled extensively, enjoying an around-the-world trip by freighter in the 1950s and sponsoring a 35-day African bird-gathering safari for the museum in 1971. They revitalized a hunting club, La Grulla, in Baja California and maintained a casita in Mazatlán and a ranch in Santa Barbara.

George was elected to the museum's Board of Trustees in 1973 and served actively through 1989. Working with ornithology curator Ralph Schreiber and his wife, Betty Anne, George and Phila sponsored a number of collecting trips to Mexico and an odyssey by luxury motor home to the area in Alberta, Canada, that served as a model for the Schreiber Hall's marshland habitat.

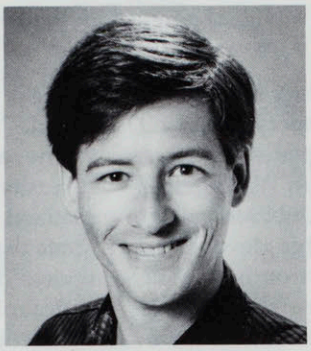
Many bird hall donors remember the day George asked for their contributions. He did so only after endorsing the project with generous personal support. Concerned with the museum's future, the Caldwells were pioneers in establishing a life income trust that will benefit the museum in years to come.

We miss George greatly.

STAFF

LLOYD KIFF HONORED. At the 108th meeting of the American Ornithologists' Union, Lloyd F. Kiff was selected as a Fellow of the organization, an honor bestowed in recognition of eminence in ornithology. Kiff has been director of the Western Foundation of Vertebrate Zoology since 1968; since 1988, he has been Curator and Section Head of Ornithology for the museum.

As team leader of the California Condor Recovery Team since 1986, Kiff has worked to formulate and implement plans for captive breeding and release of the species back to the wild. He has participated in a number of expeditions to neotropical America, Borneo, and Africa and has published 70 scientific papers,including a number on breeding and reproduction in birds, effects of pesticides on birds, and other topics illuminated by study of bird eggs.



NEW CURATOR OF INVERTEBRATES. Dr. J. Kirk Fitzhugh is the Natural History Museum's new Assistant Curator of Annelids in the Section of Invertebrate Zoology. He will be responsible for the museum's extensive holdings of marine and estuarine segmented worms, or annelids, a collection second in size only to that at the Smithsonian Institution.

Dr. Fitzhugh's research concerns the morphology, systematics, and evolutionary relationships of marine annelids, called polychaetes. He recently completed a 2-year appointment as Thorne Research Fellow at the American Museum of Natural History in New York City, revising the fan-worm polychaete family Sabellidae. His future research will include an analysis of evolutionary relationships among the more than 80 families of polychaetes.

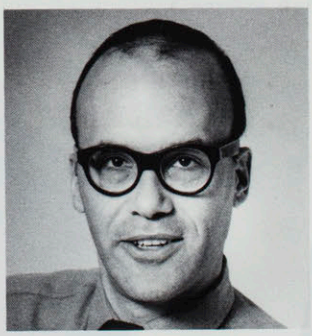
Dr. Fitzhugh received his bachelor of science and master of science degrees from Texas A&M University and his Ph.D. from George Washington University in association with the Smithsonian Institution.

NEW MANAGING EDITOR FOR TERRA. Ann Seaman has joined the staff of the museum's Publications Office as Editor. Her primary responsibility will be the editing and design and

production coordination of TERRA; she will also produce the Calendar of Events for Museum Members and brochures for museum visitors.

Seaman received a B.S., with honors, from the University of Texas at Austin in 1975 and will receive a master's degree in Professional Writing from the University of Southern California in May 1991. She was public relations director for the Austin-Travis County mental Health/Retardation Center in Austin for four years and has worked on a number of publications in the sciences and humanities, including a botanic encyclopedia to be published by the University of Texas Press and *Hungarian Immigrants to Texas* (Institute of Texan Cultures, 1989).

Seaman replaces Kathy Talley-Jones, who resigned after 6 years with the museum to become Managing Editor for the Getty Center for Education in the Arts.



NEW BOOKS AND JOURNALS EDITOR. Richard C. Hink has been hired as Book and Journal Editor in the museum's Publications Office. He will edit and coordinate the production of the museum's scholarly books and series,

Continued on p. 61

THE RALPH W. SCHREIBER HALL OF BIRDS

Birds...were thought to know the secret of all living things,
to have great foresight and to fill with wisdom
the hearts of those who took the trouble
to learn their language and listen.

Laurens Van der Post, *A Story Like the Wind*

The Natural History Museum of Los Angeles County is pleased to announce the opening in January 1991 of the Ralph W. Schreiber Hall of Birds, an exhibition gallery and research center devoted to birds and the environment. The hall uses the entire spectrum of exhibition and educational technology, including videotaped presentations, computer-controlled habitats and animation, and mechanical devices that invite the visitor to interact with a variety of sources of information.

The visitor to the Schreiber Hall is immersed in discovery through three walk-through habitats featuring "animatronic" animals, twenty-seven interactive learning stations on bird biology, a reference room with mounted specimens and drawers of artifacts, and a computerized bird encyclopedia. In short, the Hall of Birds is an artful and stimulating environment, the most modern exhibit of its kind in any natural history museum in the world.

The astonishing beauty and diversity of bird life, which is dramatized in the new hall, demonstrate the ability of birds to adapt to widely differing habitats and ecological niches, from the ice floes of Antarctica to the artificial aeries of urban office towers. The hall offers a wealth of information about the variety of forms of birds and the strategies that they employ to survive.

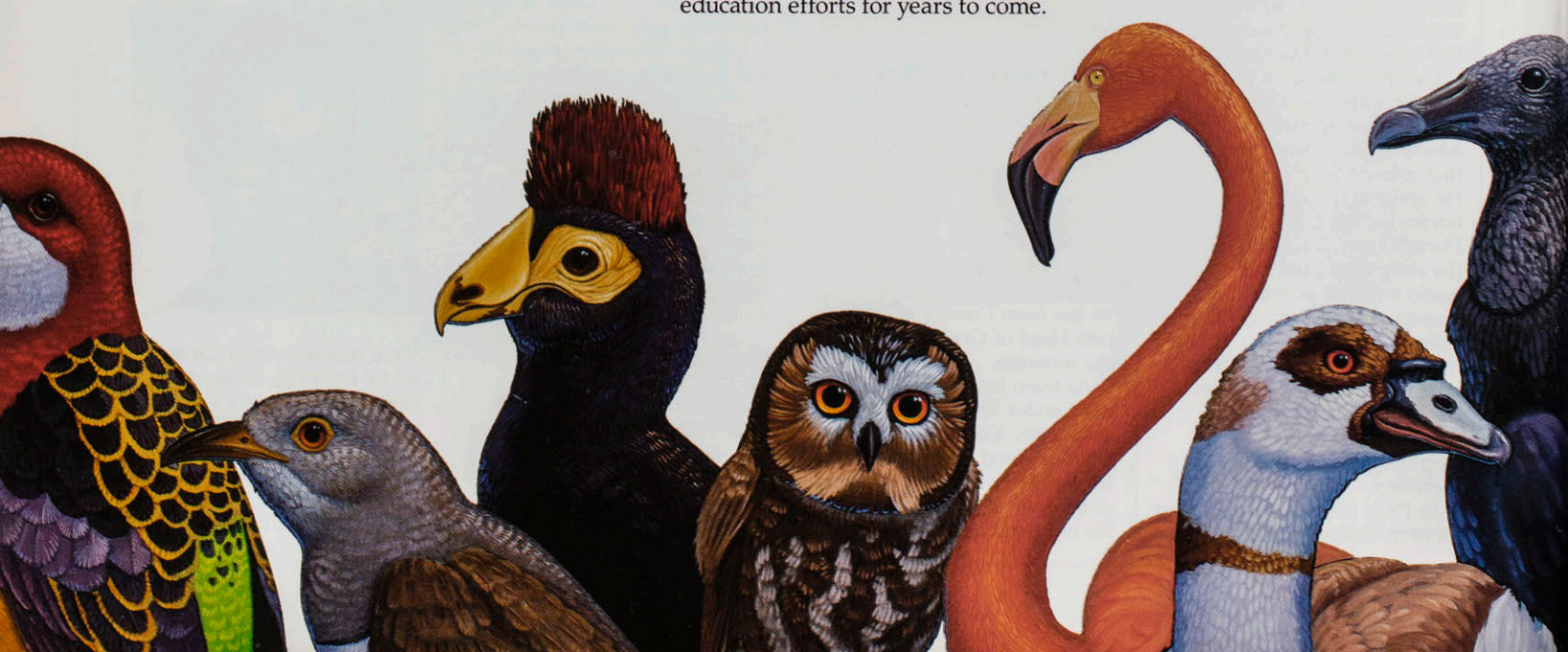
Birds are especially sensitive indicators of changes in the environment, and their fate may signal our own. The information in the new hall is therefore organized to emphasize concepts relating to ecology and conservation. The profound message underlying the exhibition is the richness of the natural world and humankind's responsibility to conserve it for the future. We expect the bird hall to be a catalyst for our environmental education efforts for years to come.

The Bird Hall is dedicated to Ralph W. Schreiber (1942–1988), a distinguished ornithologist who was Curator and Section Head of Ornithology at the Natural History Museum for nearly 12 years. Dr. Schreiber was the world's leading authority on pelicans and was internationally renowned for his studies of seabirds and, in particular, of their responses to the catastrophic El Niño-Southern Oscillation episodes of the 1980s.

Dr. Schreiber was a staunch advocate of the museum's bird collections, which grew in new directions during his tenure. He was also a gifted teacher, skilled at interpreting scientific findings for people of all ages and backgrounds and generating immense enthusiasm for biology.

In all of his activities Dr. Schreiber enjoyed the close collaboration and professional contributions of his wife, Elizabeth Anne. Upon arriving at the museum, the Schreibers began to envision a new hall of birds, an interactive environmental center to serve as a resource for southern California's large population of professional ornithologists and avid nature enthusiasts.

Work on the hall has been carried forward since Dr. Schreiber's death by Elizabeth Anne Schreiber, under the overall direction of James D. Olson, Chief of the Exhibitions



Division. Promotion Products, Inc., of Portland designed and fabricated the hall. Charles R. Fischer, Head of the Habitats Section, coordinated the day-to-day efforts of staff and volunteer workers, and Timothy A. Bovard, Taxidermist in Habitats, prepared bird specimens and acted as liaison with the hall's animation fabricators.

Lloyd F. Kiff, Director of the Western Foundation of Vertebrate Zoology and Curator of Ornithology at the museum since September 1988, has supervised the final organization of information in the exhibitions, with the expert assistance of Kimball L. Garrett, Collections Manager for Ornithology, and Judith L. Chovan, Science Education Specialist in the museum's Education Division.

In the Schreiber Hall of Birds, adults and children, birders and sportsmen, educators and the general public—all those who love nature and hope to preserve it for future generations—have access to the information and insight that represents the science of ornithology.

I congratulate all who participated in this major achievement of the Natural History Museum's capital campaign, and I invite you to enjoy the beauty of the new hall and the opportunities for enjoyment and enlightenment that it holds.

CRAIG C. BLACK, Director

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Special thanks to: Karastan Rug Mills, Spacesaver Corporation, and Donors to Bird Quest '89, The Herbert Friedmann Memorial Fund, The Jean Delacour Memorial Fund, and The George V. Caldwell Memorial Fund

Details from a mural in the entrance to the new Schreiber Hall of Birds illustrating representative members of the orders of living birds. Mural by Michael Meaker, Museum Graphic Artist.

THE BIG TREES

Excerpts from *The Yosemite* by JOHN MUIR
With photographs by GALEN ROWELL.

No other tree in the world, as far as I know, has looked down on so many centuries as the sequoia or opens so many impressive and suggestive views into history. Under the most favorable conditions these giants[1] probably lived 5000 years or more, though few of even the larger trees are half as old. The age of one that was felled in Calaveras grove, for the sake of having its stump for a dancing-floor, was about 1300 years, and its diameter measured across the stump twenty-four feet inside the bark. Another that was felled in the Kings River forest was about the same size but nearly a thousand years older (2200 years), though not a very old-looking tree.

So harmonious and finely balanced are even the mightiest of these monarchs in all their proportions that there is never anything overgrown or monstrous about them. Seeing them for the first time you are more impressed with their beauty than their size, their grandeur being in great part invisible; but sooner or later it becomes manifest to the loving eye, stealing slowly on the senses like the grandeur of Niagara or of the Yosemite Domes. When you approach them and walk around them you begin to wonder at their colossal size and try to measure them. They bulge considerably at the base, but not more than is required for beauty and safety and the only reason that this bulging seems in some cases excessive is that only a comparatively small section is seen in near views. One that I measured in the Kings River forest was twenty-five feet in diameter at the ground and ten feet in diameter 220 feet above the ground, showing the fineness of the taper of the trunk as a whole. No description can give anything like an adequate idea of their singular majesty, much less of their beauty. Except the sugar pine, most of their neighbors with pointed tops seem ever trying to go higher, while the big tree, soaring above them all, seems satisfied. Its grand domed head seems to be poised about as lightly as a cloud, giving no impression of seeking to rise higher. Only when it is young does it show like other conifers a heavenward yearning, sharply aspiring with a long quick-growing top. Indeed, the whole tree for the first century or two, or until it is a hundred or one hundred and fifty feet high, is arrowhead in form, and, compared with the solemn rigidity of age, seems as sensitive to the wind as a squirrel's tail. As it grows older, the lower branches are gradually dropped and the upper ones thinned out until comparatively few are left. These, however, are developed to a great size, divide again and again and terminate in bossy, rounded masses of leafy branchlets, while the head becomes dome-shaped, and is the first to feel the touch of the rosy beams of the morning, the last to bid the sun good night. Perfect specimens, unhurt by running fires or lightning, are singularly regular and symmetrical in general form, though not in the least conventionalized, for they show extraordinary variety in the unity and harmony of their general outline. The immensely strong, stately shafts are free of limbs for one hundred and fifty feet or so. The large limbs reach out with equal boldness in every direction, showing no weather side, and no other tree has foliage so densely massed, so finely molded in outline and so perfectly subordinate to an ideal type. A particularly knotty, angular, ungovernable-looking branch, from five to seven or eight feet in diameter and perhaps a thousand years old, may occasionally be seen pushing out from the trunk as if determined to break across the bounds of the regular curve, but like all the others it dissolves in bosses of branchlets and sprays as soon as the general outline is approached. Except in picturesque old age, after being struck by lightning or broken by thousands of snow-storms, the regularity of forms is one of their most distinguishing characteristics. Another is the simple beauty of the trunk and its great thickness as compared with its height and the width of the branches, which makes them look more like finely modeled and sculptured architectural columns than the stems of trees, while the great limbs look like rafters, supporting the magnificent dome-head. But though so consummately beautiful, the big tree always seems unfamiliar, with peculiar physiognomy, awfully solemn and earnest; yet with all its strangeness it impresses us as being more at home than any of its neighbors, holding the best right to the ground as the oldest, strongest inhabitant. One soon becomes acquainted with new species of pine and fir and spruce as with friendly people, shaking their outstretched branches like shaking hands and fondling little ones, while the venerable aboriginal sequoia, ancient of other days, keeps you at a distance, looking as strange in aspect and behavior among its neighbor trees as would the mastodon among the homely bears and deer. Only the Sierra juniper is at all like it, standing rigid and unconquerable on glacier pavements for thousands of years, grim and silent, with an air of

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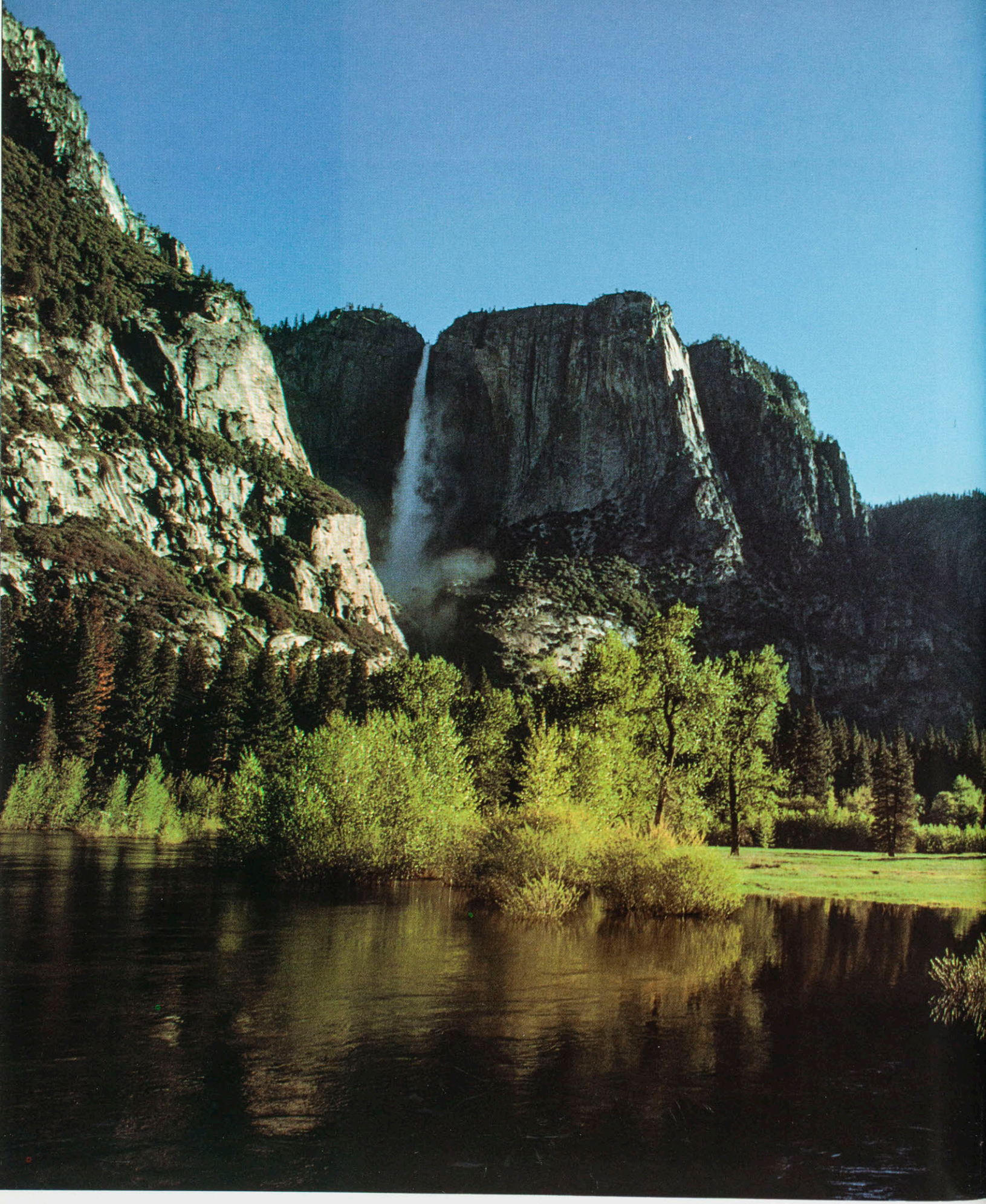
Winter in the Merced Grove of giant sequoias, 1979.

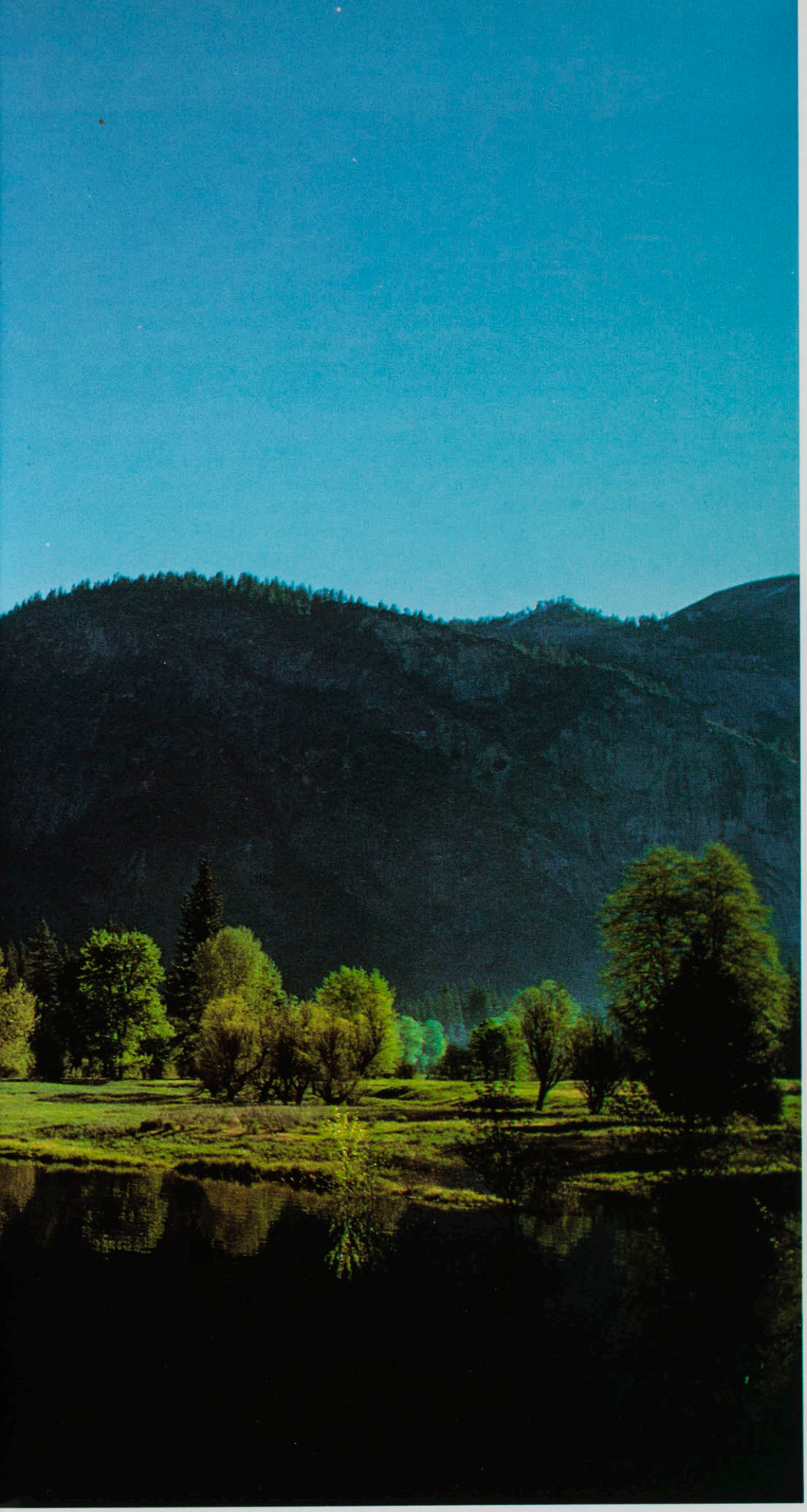
1. Muir refers to *Sequoiadendron giganteum* (Lindl.) Buchh., the sequoia or redwood of the Sierra Nevada, which is commonly known as the giant sequoia or big tree. It is distinct from *Sequoia sempervirens*, the coast redwood, which grows along the Pacific Coast from California's Monterey County north into Oregon, and *Metasequoia glyptostroboides*, the dawn redwood, a deciduous tree that was known only as a fossil before 1941, when living individuals were discovered in China. The redwoods and a few related conifers belong to the family Taxodiaceae.

When Muir wrote *The Yosemite* the scientific name of the giant sequoia was *Sequoia gigantea*.

Mule deer in last light, Yosemite Valley, 1976.

Hanging meadow on Mount Conness, 1987.





Merced River in flood below Yosemite Falls, 1974.

Continued from p. 11

antiquity about as pronounced as that of the sequoia....

It is constantly asserted in a vague way that the Sierra was vastly wetter than now, and that the increasing drought will of itself extinguish the sequoia, leaving its ground to other trees supposed capable of flourishing in a drier climate. But that the sequoia can and does grow on as dry ground as any of its present rivals is manifest in a thousand places. "Why, then," it will be asked, "are sequoias always found only in well-watered places?" Simply because a growth of sequoias creates those streams. The thirsty mountaineer knows well that in every sequoia grove he will find running water, but it is a mistake to suppose that the water is the cause of the grove being there; on the contrary, the grove is the cause of the water being there. Drain off the water and the trees will remain, but cut off the trees, and the streams will vanish. Never was cause more completely mistaken for effect than in the case of these related phenomena of sequoia woods and perennial streams.

When attention is called to the method of sequoia stream-making, it will be apprehended at once. The roots of this immense tree fill the ground, forming a thick sponge that absorbs and holds back the rain and melting snow, only allowing it to ooze and flow gently. Indeed, every fallen leaf and rootlet, as well as long clasping root, and prostrate trunk, may be regarded as a dam hoarding the bounty of stormclouds, and dispensing it as blessings all through the summer, instead of allowing it to go headlong in short-lived floods.

Since, then, it is a fact that thousands of sequoias are growing thriftily on what is termed dry ground, and even clinging like mountain pines to rifts in granite

Alpenglow on storm clouds, Yosemite Valley, 1986.

precipices, and since it has also been shown that the extra moisture found in connection with the denser growths is an effect of their presence, instead of a cause of their presence, then the notions as to the former extension of the species and its near approach to extinction, based upon its supposed dependence on greater moisture, are seen to be erroneous....[2]

There is no absolute limit to the existence of any tree. Death is due to accidents, not, as that of animals, to the wearing out of organs. Only the leaves die of old age. Their fall is foretold in their structure; but the leaves are renewed every year, and so also are the essential organs—wood, roots, bark, buds. Most of the Sierra trees die of disease, insects, fungi, etc., but nothing hurts the big tree. I never saw one that was sick or showed the slightest sign of decay. Barring accidents, it seems to be immortal. It is a curious fact that all the very old sequoias had lost their heads by lightning strokes. "All things come to him who waits." But of all living things, sequoia is perhaps the only one able to wait long enough to make sure of being struck by lightning.

So far as I am able to see at present only fire and the ax threaten the existence of these noblest of God's trees. In Nature's keeping they are safe, but through the agency of man destruction is making rapid progress, while in the work of protection only a good beginning has been made.... The big tree, leaving all its higher uses out of the count, is a tree of life to the dwellers of the plain dependent on irrigation, a never-failing spring, sending living waters to the lowland. For every grove cut down a stream is dried up. Therefore all California is crying, "Save the trees of the fountains." Nor, judging by the signs of the times, is it likely that the cry will cease until the salvation of all that is left of *Sequoia gigantea* is made sure.

2. Muir's intriguing theories on the link of water and sequoias are not widely held by forestry experts today. His legacy is not his scientific contribution but rather his forceful presentation to the American public of the beauty, dignity, and longevity of the sequoias.

In celebration of the 100th anniversary of the founding of Yosemite National Park, nature photographer Galen Rowell has published 101 of his full-color images of Yosemite alongside the complete text of John Muir's classic The Yosemite, *a recounting of the naturalist's adventures in Yosemite Valley at the end of the last century that was first released in 1912. This article is excerpted from the new book, which was published by Sierra Club Books in 1989. In winter 1990–1991, the Natural History Museum is hosting an exhibition based on the book.*

Muir, who was born in Scotland in 1838, grew up in Wisconsin and attended the university there, studying chemistry and geology and developing a consuming interest in botany. After college and a brief career in factory work, he resolved to devote his life to the study of nature and began to travel on foot throughout the western states. When he was in his forties, he married and settled for a time in California's Alhambra Valley near Martinez, where he gained financial independence by successfully operating a fruit ranch. But after 1891 he resumed his walking tours of wilderness areas of North America, keeping journals of his adventures and observations; these notebooks formed the basis of books and articles that were published late in his life and posthumously (Muir died in Los Angeles in 1914).

In 1889 John Muir took Robert Underwood Johnson, an editor of Century Magazine, *on a camping tour in the vicinity of Yosemite Valley to show Johnson the devastation wrought by sheep grazing in the region. The two men initiated a campaign for the establishment of a wilderness preserve at the base of the Sierras. Muir's eloquent essays on Western forests and scenery in the* Century *and* Scribner's Monthly *had profound effects on the public mind, and a great conservation era in the United States began with the passage of the Yosemite National Park bill by Congress in October 1890. Muir used subsequent publications, including articles in* Harper's Weekly *and* Atlantic Monthly, *and his intimacy with President Theodore Roosevelt, to expound on the need for more forest reserves and national parks. He was without doubt the most important environmental advocate of his age.*

Galen Rowell, who was born in Berkeley, California, in 1940, has spent the last 20 years in wilderness exploration and photography. He has participated in more than one thousand mountain climbs and has worked on assignment for National Geographic *and other publications. In 1984 he received the Ansel Adams Award from the Sierra Club for his contribution to wilderness photography. Among his books are* Mountain Light *(Sierra Clubs Books, 1986) and* The Art of Adventure *(Collins, 1989). Most recently he has provided introduction and photographs for* My Tibet *by the Dalai Lama, which was published in fall 1990 by the University of California Press.*

The adventures of John Muir and Galen Rowell in Yosemite are separated by a century, but the new edition of The Yosemite *is evidence of their shared conviction that the salvation of wild places is rooted in public awareness.*

Photographs courtesy of Galen Rowell/Mountain Light.

RUSSIAN AMERICA AND THE FINNS

by LYDIA T. BLACK and RICHARD A. PIERCE

This winter the Natural History Museum of Los Angeles County is hosting an unusual exhibition of Alaskan and Northwest Coast artifacts from the National Museum of Finland in Helsinki, whose collections from this region rival and in many respects surpass the best and richest collections in the world, including those in the United States and Soviet Union. The entire body of artifacts dates to the nineteenth century, and many pieces are among the earliest examples of Native Alaskan aboriginal art and traditional cultural heritage.

At the core of the Alaskan and Northwest Coast holdings in Helsinki are ethnographic materials collected by a remarkable man, Arvid Adolf Etholen (1799–1876; in Russian records, Adolf Karlovich Etolin). Etholen, who spent most of his adult life in Alaska and was its governor from 1840 to 1845, is considered by most Alaskan historians to be the founding father of the Finnish community that developed in Alaska in the 1800s.

The excellence of the National Museum of Finland's collections is vividly demonstrated by the exhibition Gifts from the Great Land, and by the few examples illustrated in this issue of TERRA. But these collections are important in yet another sense: they are a memorial to the Finnish men and women who actively participated in the shaping of Alaskan history, and thus in the history of the United States. The story of this early Finnish community on American soil has never been fully told, and the information contained in a few scholarly works on Russian America is not readily available to the general reader. This essay will, we hope, serve in some measure to remedy this deficiency.

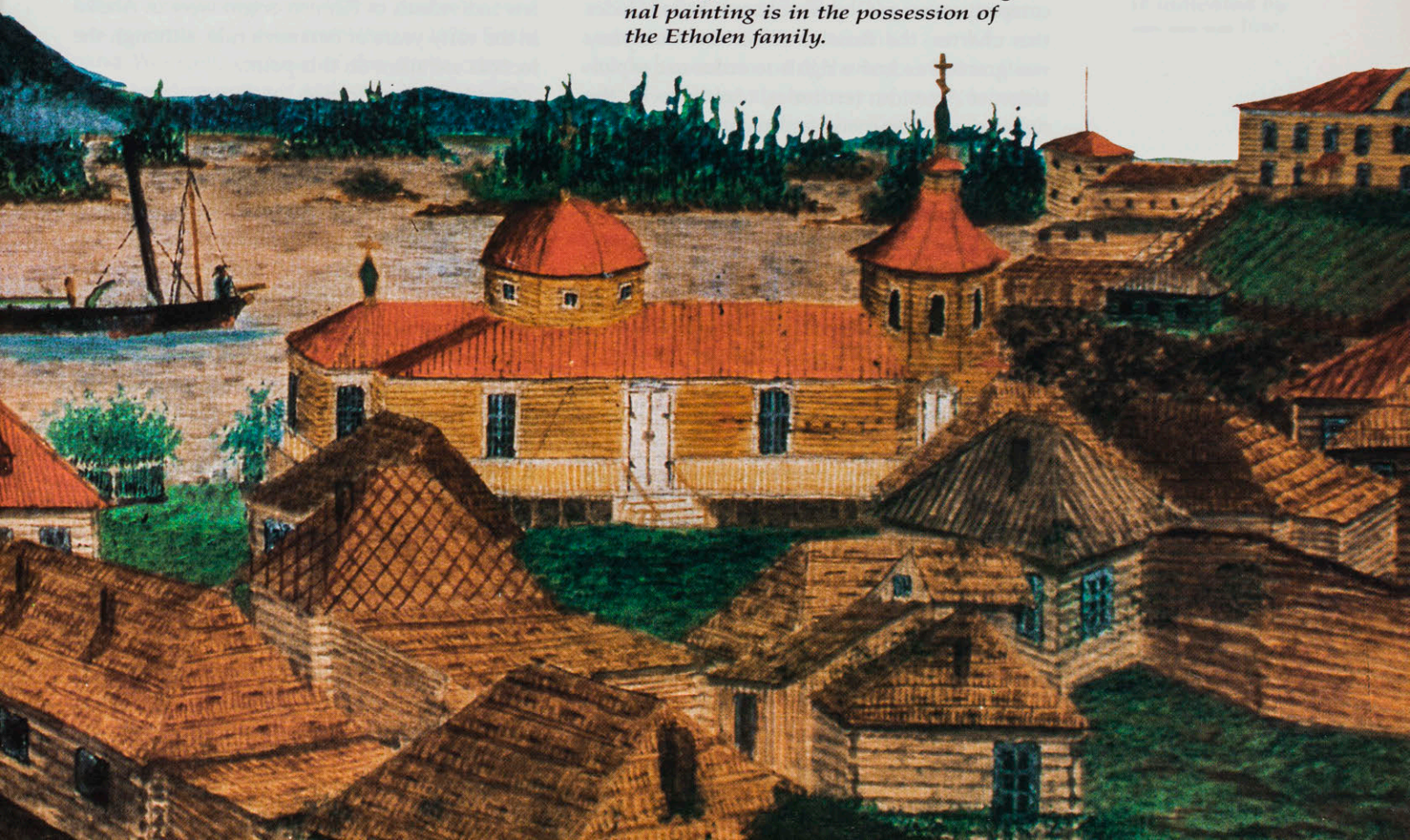
Russian sovereignty over Alaska was established in 1741 by the voyage of two naval vessels to North America's Pacific shore under the command of Vitus Bering. The present boundaries of Alaska, which were established more than 80 years later by international treaties between Imperial Russia and Great Britain (1824) and the United States (1825), were determined on the basis of landfalls made by Bering at Kayak Island and by his second in command, Aleksei Chirikov, in the vicinity of modern Ketchikan.

In the decades following Bering's exploration, private entrepreneurs sailed from Kamchatka and Okhotsk along the Aleutian Islands in search of sea otter, fur seal, and fox for the China fur trade. By the 1780s, there were trading posts and quasi-permanent harbors where Russian merchant vessels often wintered along the Aleutian Island chain and also on the Alaska Peninsula, in Bristol Bay, and in the Pribylov Islands in the Bering Sea.

In 1784 Grigorii Shelikhov, a merchant and fur trader, obtained by force a foothold on Kodiak Island from which he planned to expand his operations to the American mainland along the Northwest Coast to California and north along the Bering Sea shores to the Bering Strait and beyond. Although the Russian government was occupied with European politics and engaged in incessant wars with Turkey and Sweden, it supported this advance in principle—and occasionally with subsidies—because successful penetration of these territories added the criterion of occupancy to the right of discovery for Russian claims on American territory.

In 1786, Empress Catherine II (the Great) readied a naval squadron under the command of Captain G.I. Mulovskii to establish a governmental presence on the American continent. In addition to securing the coast from Nootka Sound on Vancouver Island (and possibly California) to the Bering Strait, Mulovksii was to become Alaska's first naval governor. But wars with Turkey and Sweden broke out anew, and the squadron never sailed. Thus the initiative remained in the hands of private interests, among whom Shelikhov soon became the most influential.

View of Sitka by an unidentified artist—probably Lieutenant Johann Joachim Bartram, a Finn who was in Alaska from 1840 to 1845. The tall, red-roofed building to the left of center is the Lutheran church built by Uno Cygnaeus in the 1840s. The original painting is in the possession of the Etholen family.



Arvid Adolf Etholen and his wife, Margaretha Hedvig Johanna Sundval; the Etholens probably posed for these portraits around the time of their marriage in 1839.

In the meantime, the political situation in Europe worsened. Napoleon was on the march, and it was not until he met his final defeat in 1814 that the Russian government was in a position to give priority to affairs in Alaska. Emperor Paul I, who had succeeded Catherine in 1796, had, however, issued a monopoly charter in 1799 to the company managed by Shelikhov's heirs. Under this charter, the Russian-American Company was granted exclusive rights to economic exploitation of American territories, together with the right to establish new settlements and expand into new areas.

The Russian-American Company's manager in Alaska became a de facto ruler of Russian possessions on the American continent, with little or no accountability to the government. This man was the legendary Aleksandr Baranov (1746–1819; in Alaska 1790–1818). Under his rule sea otters and fur seals were hunted as far away as modern San Diego and Baja California from fleets of baidarkas (kayaks) manned by impressed Kodiak Islanders, Aleuts from the eastern sector of the Aleutian archipelago, volunteer contingents of Chugach from Prince William Sound, Alutiiqs from the Alaska Peninsula, and Dena'ina (Athabaskans) from Kenai Peninsula. They brought salt to Alaska from the Gulf of California. And they helped Baranov gain a foothold in the Tlingit territory, establish the future colonial capital of Novoarkhangel'sk (modern Sitka), found Fort Ross in California, and set up an outpost (albeit a short-lived one) in Hawaii.

Always short of manpower, Baranov was very hospitable to foreign nationals who either entered Russian-American Company service or became political allies and trading partners. Among his employees were Englishmen, "Bostonians" (as Russians called the American Yankees), Germans, and Swedes. It is possible that a few individuals of Finnish origin were in Alaska in the early years of Baranov's rule, although the records are silent on this point.

Positive identification of Finns arriving in Alaska is only documented after Finland became, in the wake of Swedish defeat in the war of 1808–1809 and the Peace of Fredericksham, an autonomous grand duchy within the Russian Empire. Now that they were citizens of the Russian Empire as well as Finland, Finns of all classes began to enter Russian service. Many were seafarers who sailed on Russian vessels, but members of the Finnish gentry and educated elite also often joined the Imperial Navy, receiving training in the Naval Cadet Corps.

One such well-born Finn was the future Rear Admiral Arvid Adolf Etholen, who was educated at the naval academy in St. Petersburg, then the capital of Russia. In 1817, at the age of eighteen, he sailed to Alaska aboard the sloop *Kamchatka*, with the famous navigator Vasilii Golovnin commanding. It was the ninth circumnavigating voyage for the Russian navy as well as a mission to provide logistic support and supplies to Russia's American colony.

Alaska and the Bering Sea region, circa 1885. Modern boundary between the United States and Canada is indicated by — — — line.

The crew for the voyage was hand-picked, and several of the young officers were destined for illustrious careers in the New World. Among Etholen's shipmates were Matvei Murav'ev, who was governor of Alaska from 1820 to 1825; Ferdinand Wrangell, explorer of the Arctic coast of Siberia and governor of Alaska from 1830 to 1835; and Fedor Litke, who also became a famous explorer of the Pacific and Arctic oceans. Also on board was a fellow Finn, Carl Schmidt, who was probably a graduate of the Corps of Naval Navigators. Schmidt was to succeed Ivan Kuskov as commandant of Fort Ross in 1821, and in 1823 he led a skin boat party up the Slavianka (Russian) River to reconnoiter California's interior. Because of his knowledge of foreign languages Schmidt was very effective in California in helping to establish and conduct trade between the Russians and the Spanish.

When the *Kamchatka* reached Sitka, Etholen and Schmidt were formally transferred to the service of the Russian-American Company to command company ships. Etholen's initial duty was to maintain communications between Novoarkhangel'sk and outlying stations in Alaska as well as with the Commander and Kurile Islands and the home ports along the Siberian coasts. Soon, however, he was frequently dispatched on voyages of exploration, particularly in the Bering and Arctic seas. He repeatedly sailed through the Bering Strait and along the northern shores of the Alaskan and Chukchi Peninsulas. In 1822 Etholen, in command of the cutter *Baranov*, and Lieutenant Khromchenko (or Khramchenko), in command of the brig *Golovnin*, thoroughly explored the estuary of the Nushagak River, the coast around the Kuskokwim River estuary, Nunivak Island, the shores of Seward Peninsula, and the Arctic Ocean in the vicinity of the Bering Strait.

In 1824 Etholen was ordered to return to navy duty, and he sailed for Kronstadt, the Baltic navy base, aboard the frigate *Kreiser* with M. Lazarev commanding. But the Russian-American Company soon needed his services again, and in 1826 he returned to Alaska, this time traveling overland to Okhotsk, where he assumed command of the company vessel *Okhotsk* and sailed on to Sitka, arriving in September. For the next seven years, most of his time was spent aboard ship: he sailed a number of times to California, the Kuriles, Okhotsk, the Chukchi Peninsula and the Bering Strait, and to other points north. It was Etholen who recommended establishment of a trading post on Seward Peninsula, and St. Michael was founded in 1833 upon his initiative.

In the meantime Etholen's old friend and shipmate, Wrangell, had become governor of Alaska.

Tlingit mask with double set of eyes. Photograph by Matti Huuhka, courtesy Finnish National Board of Antiquities.

Etholen worked closely with Wrangell and his successor, Ivan Kupreianov, serving at intervals as port commander of Sitka and in 1831 and 1836 as second in command to the governor.

In 1837 Etholen returned to Russia and resumed naval duty. But late in 1838 he was appointed Alaska's governor. In June of 1839, in Finland, he married Margaretha Hedvig Johanna Sundval (1814–1894), a daughter of a provincial judge; he was forty, she twenty-four. In August of that year, the couple sailed for Alaska aboard the ship *Imperator Nikolai I* on a lengthy voyage around the world that included a long stay in Brazil.

Margaretha Etholen was a very devout woman (Etholen himself, in his later years, had a reputation for being rather straitlaced) and, like the majority of Finns, a Lutheran. To serve the growing number of Finns in the employ of the Russian-American Company, Ugo Cygnaeus (1810–1888) traveled with the Etholens to Alaska to become its first Lutheran pastor.

Cygnaeus would by 1843 build the first Lutheran church on the west coast of North America to a plan that he drew himself. Located along a street that parallels the shore, it was an imposing building, as may be seen on a watercolor of Sitka in the possession of the Etholen family today. Etholen donated communion vessels, a six-rank pipe organ built in Tartu, Estonia, and an altar painting depicting the Transfiguration by a well-known Finnish artist, Goldenhjelm. Finnish artisans in Sitka made the candelabra of gesso work, the pulpit, and the altar with rails, pews, and balcony for the organ.[1] Mrs. Etholen, assisted by her women companions, made all the paraments.

Cygnaeus also established a Lutheran cemetery in Sitka. His congregation would, however, remain small: during his five-year tenure he performed only three baptisms, confirmed five persons, and officiated at two weddings and fourteen funerals. Nonetheless he traveled on company ships to many places in Alaska to visit his parishioners stationed in remote outposts. On his travels Cygnaeus collected curiosities and natural science and ethnographic specimens, some of them outstanding and one—an Aleut hunting helmet apparently from Atka—unique. While in Sitka, he kept meteorological records.

After his return to Finland in 1845, Cygnaeus became a famous educator, an authority on Finnish folklore, and a promoter of Finnish national identity and the use of Finnish as the official language of Finland. He died in Finland in the same year that the Lutheran church he built in Sitka was torn down. After the destruction of the building, Goldenhjelm's painting of the Transfiguration was placed in the Orthodox Cathedral of St. Michael where today it has the place of honor at the Royal Gate of the iconostasy.

Johann Joachim Bartram, another of the many outstanding Finns that Etholen recruited for service in Alaska, had traveled there with the Etholens aboard the *Imperator Nikolai I*. Bartram (1809–1865) was a gifted linguist and, to judge by the watercolors in the possession of the Lars Krogius and Etholen families, a fine amateur artist. He was a career navy officer and a graduate of the Naval Cadet Corps in St. Petersburg. He had sailed in the Mediterranean, Adriatic, and Baltic seas and had seen action in the War for Greek Independence. He was severely wounded in the naval battle of Navarino in 1827; believed to be dead, he escaped being thrown overboard by a mere chance, when one of the physicians noted a sign of life.

In 1839 Bartram, who then held the rank of lieutenant, was offered a post with the Russian-American Company. At the time he was engaged to Margaretha Charlotta Schwartz, but her father strenuously objected to the marriage taking place. Nevertheless, Lieutenant Bartram carried

1. The organ, the candelabra, and the communion rail with kneelers survive and are used today in Sitka's Lutheran church.

A bentwood helmet, probably from Atka Island in the Aleutians; collected by Uno Cygnaeus, the first Lutheran pastor in Alaska. It is unique in its design and in the beauty of its decoration. Photograph by Dick Meier.

the day: he and Margaretha were married, and the new Mrs. Bartram traveled with her husband to Alaska.

Bartram was to be Etholen's second in command on the voyage. En route to Sitka, in Valparaiso, Chile, he took command of a ship that the Russian-American Company had acquired there, the *Grand Duke Konstantin*, and sailed her from Chile to Alaska. While in Alaska, he frequently sailed company ships, making several trips to Carmen Island in the Gulf of California for salt, which was necessary as a food and fur preservative, as well as to various Alaska outposts and Siberian ports. Promotions came his way swiftly, and in 1845 he received the rank of captain-lieutenant and was offered the post of governor to succeed Etholen. He chose to return home, however, leaving Alaska in 1845.

Apparently on the insistence of her father, Margaretha Bartram had been accompanied on her wedding journey to Alaska by her younger sister, Vilhelmina Ulrika. Mr. Schwartz later regretted his decision to send Vilhelmina to the colony, for in Sitka the girl fell in love and married A. M. Gavrilov, a young navy officer in the service of the Russian-American Company. Vilhelmina remained with her husband when her sister and brother-in-law left Alaska, and she bore two daughters in Sitka; she returned to Finland with her children only after Gavrilov's death in 1848.[2]

Etholen had recruited a number of Finns to serve in the colonies as carpenters, shipwrights, and sailors, and some of these men traveled below decks on the 1839 voyage of the *Imperator Nikolai I*. Servants also came along. There was Karl Enberg, who had been Etholen's orderly since 1834; another male servant, Johannes; Margaretha Etholen's housekeeper, Anna Margretha Carlotta Oehman; and Anna Margretha's fifteen-year-old daughter, Elise. In 1845, Elise married the Finnish physician Alexander Friedrich Frankenhaeuser (1811–1884), who had come to Sitka in 1841. The Frankenhaeusers remained in Alaska until 1852; five of their nine children were born in Sitka.

A not very willing member of the party was Reinhold Ferdinand Sahlberg (1811–1874), a native of Abo (modern Turku) and a candidate of medicine in 1839 at Helsinki University. Sahlberg dreamed of being a naturalist and explorer, and he sailed aboard the *Imperator Nikolai I* planning to stay in Chile. But his ambitious plans went awry during the difficult voyage; Mrs. Etholen

2. Lieutenant Gavrilov's grave is one of the few in the old Russian cemetery in the center of Sitka with the gravestone surviving intact.

A Kodiak man's parka of cormorant skins, decorated with embroidery and tassels of leather and white rabbit fur. Photograph by Matti Huuhka, courtesy Finnish National Board of Antiquities.

was pregnant and—to judge by her diary—miserable, and her anxious husband persuaded (some would say pressured) the young Dr. Sahlberg to continue the voyage to Sitka. Sahlberg was promised a salary of 6,000 rubles if he would stay for one year and serve as the second physician at the Novoarkhangel'sk hospital, working as obstetrician and also treating children's ailments.

On April 6, 1840, Sahlberg performed his first delivery when Mrs. Etholen gave birth to a son at sea. The boy was christened several weeks later by Uno Cygnaeus and given the name Edvard. Both mother and child were sick, and Sahlberg wrote that a great effort had to be made to save the baby's life. The child did not live long: Edvard died in Sitka on October 25, 1841. On his grave, the Etholens erected a simple metal cross that bears only Edvard's name and the date of his death.

The Etholen's were to have three more sons—Alexander, born May 19, 1841, in Sitka;[3] Wilhelm, who was probably born in 1843 or 1844, also in Sitka; and Adolf, born in 1846 in Finland. But Mrs. Etholen never recovered from the loss of Edvard. Shy, retiring, lonely, and melancholy, she devoted her time to good works and her church. She assisted her husband in reestablishing a school for girls in Sitka, and she encouraged the adoption of orphaned children by company officials. The Etholens themselves adopted a boy and a girl. Their friends, the Bartrams, adopted two Tlingit girls, one of whom later became a teacher in the Sitka school, and a creole[4] girl, Stefanida Andreianovna Ponomarev.

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3. Alexander Etholen married a Bostonian, Catherine Selfridge, whom he had met in San Francisco in 1863 while he was commanding a ship of Admiral Popov's flotilla. Although married in Washington, D.C., the two lived most of their lives in Finland and died there, he in 1901 and she in 1925.

4. The term "creole" designated a person who could claim descent in paternal line from a Russian but whose other ancestors were Alaskans; sometimes such descent was putative.

Remarkable Women

Many landmarks in Alaska are named for Etholen and Furuhjelm and for other Finnish men who served in the Russian-American Company. But none commemorate the remarkable women who bore much hardship with courage, good grace, and humor and assisted their male kinfolk in shaping Alaska.

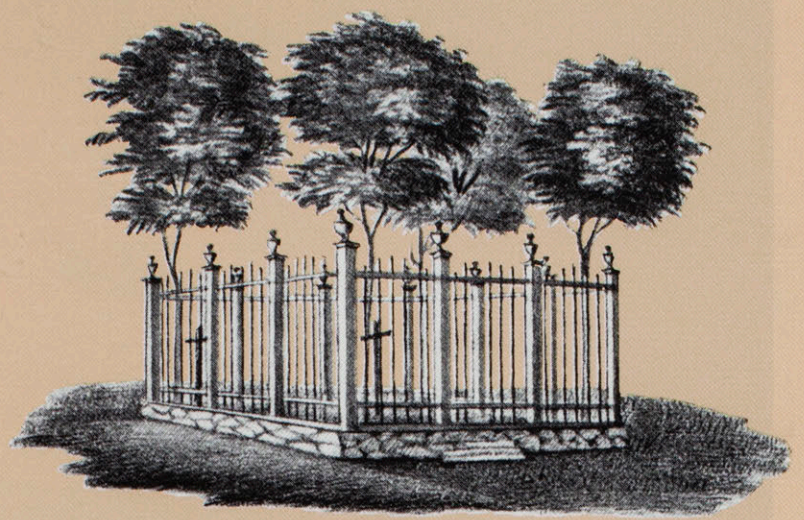
Lizzie Krogius, wife of the sea captain Lars, was indomitable: she accompanied her husband on his voyages, bore several children at sea, and always remembered her Alaskan years as the best time of her life.

Johan Furuhjelm's wife Anna Elizabeth (1836–1894) was one of the two daughters of Anne Campbell, a Scot, and Nils von Schoultz, a Finn. Shortly after her birth, her father abandoned the family to lead a Fenian raid into Canada, and he was hanged in Kingston, Ontario, in December 1837. The girls were brought up by their mother at the court of Hesse in Germany, but in 1857 they joined the von Schoultz family in Finland.

Anna Elizabeth married Johan Hampus in February 1859, on the eve of his departure for Alaska. She was fifteen years younger than her husband, but the marriage proved to be a happy one. Anna's letters to her mother reveal much about the daily life of a governor's lady in Sitka and much of her own strong and cheerful character.

Anna Furuhjelm bore three children in Sitka; the eldest was Annie Frederika, born in 1859, who became famous as an advocate of Finnish women's rights, a member of Finnish parliament, and a writer. During the revolution, when Finland had finally become an independent country and anti-Russian sentiment ran high in Helsinki, Annie—then fifty-nine years old—singlehandedly challenged a crowd bent on demolishing a monument to Emperor Alexander II. She argued that the statue represented part of Finnish historical heritage, and she vowed to protect it from destruction. The crowd listened, the statue survived, and today Finns point it out to visitors as a remembrance of "the period of autonomy within the Russian Empire" as opposed to the time of "Swedish domination."

Constance Furuhjelm (1836–1861), sister to Johan and Enoch Furuhjelm, came to Alaska with her brothers. In Sitka she became a friend of the first wife of Prince Maksutov, the last Russian governor of Alaska. Both young women were well liked and are remembered for their kindness. The two died in Sitka, and they were buried next to each other in the Sitka cemetery.



The graves of Constance Furuhjelm, sister of Governor Johan Furuhjelm, and her friend, Princess Adelaide Maksutov, who was the first wife of the last Russian governor of Alaska. From an 1867 illustration (only the marker on Princess Maksutov's grave survives). Courtesy Richard A. Pierce.

When Annie Furuhjelm, daughter of Governor Furuhjelm, published this picture in her memoirs, she entitled it "The Americans": Annie and her brothers Otto and Ellis were all born in Sitka in the 1860s. Courtesy Finnish National Board of Antiquities.

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Mrs. Etholen wrote home often, and the plan of the governer's house and detailed descriptions of each room and its furnishings that she included in these letters are extremely valuable documents that may one day serve as the a basis for reconstruction of the historic building, which was destroyed by fire in 1894.

As governor of Alaska, Etholen gave the utmost attention to company interests. During his tenure Lieutenant Zagoskin (whom Etholen did not highly regard) explored the Alaskan interior to determine the best way to utilize the Native trading networks from the North Slope to the Yukon and from Alaska to Siberia across the Bering Strait. Also at this time, the naturalist Il'ia Voznesenskii collected natural science specimens and ethnographic materials for the Academy of Sciences in St. Petersburg and for the museum in Novoarkhangel'sk.[5].

Life in Sitka was enhanced not only by the presence of the Lutheran pastor Uno Cygnaeus but also by that of Innokentii Veniaminov, the first ruling bishop of the Orthodox Church in Alaska, who arrived in Sitka in 1840. Veniaminov—who has been canonized and is known as Saint Innocent, Apostle to Alaska—established his see in Sitka; St. Michael Cathedral was built during his tenure.

The two clerics at first did not coexist without friction: a Lutheran governor ruled the colony, and a Lutheran pastor conducted weekly services in a special chapel established in the governor's residence. Etholen nevertheless was often irritated by Cygnaeus's zeal. The Lutheran church was to be completed before the new Orthodox cathedral could be finished, and Veniaminov declared that the Lutheran church was not to have either a spire or bells. The governor, acting as a mediator, had to concede the point, But by the time Cygnaeus left the colony, the two clergymen were on excellent terms. When the Etholens gave a farewell party for the departing Cygnaeus, Bishop Innokentii praised him for his excellent ministry and expressed hope that his work would be continued.

Ugo Cygnaeus's work was carried on, first by Gabriel Plathan, who was appointed to Sitka in 1845 and departed in 1852, and later by Gustaf Winter, who was in Alaska from 1852 to 1865. When Winter left, Maksutov—who was then

5. Part of Voznesenskii's ethnographic collection is now in Harvard University's Peabody Museum of Archaeology and Ethnography. Voznesenskii probably also contributed to Etholen's collections—we know that he helped pack a part of the Etholen material for shipment to Finland (P. Varjola, National Museum of Finland, personal communication).

governor—asked for a replacement; however, no new pastor arrived prior to the sale of Alaska to the United States in 1867, and the Lutheran church that Cygnaeus had built in Sitka fell into disuse.

Etholen is remembered as one of the ablest governors of Alaska and as an outstanding seaman; probably no man in the nineteenth century knew the dangerous waters of the North Pacific and the Bering Sea better than he did. He left Alaska with his family in 1845, and when he arrived in St. Petersburg in 1846 he received just recognition and many awards. He was released from navy service in 1847 with the rank of rear admiral.

Etholen was later elected to the Board of Directors of the Russian-American Company and continued to maintain interest in its affairs for many years, recruiting promising young Finns for service in Alaska.

Among the Finns who served in Alaska during the decades after Etholen's departure were a number of seamen, including the sea captains J. Conradi and Lars Krogius, who eventually founded the Finnish Steamship Company, an enterprise still in existence today. The Finnish community also included many professionals, such as Dr. Frankenhaeuser (who married the daughter of the Etholen's housekeeper, mentioned earlier) and Frankenhaeuser's brother Friedrich or Fritz, a mining engineer. Henrik Holmberg and the brothers Furuhjelm, one of whom was governor of Alaska on the eve of Russian withdrawal from the American continent, deserve particular attention.

Henrik Johan Holmberg was a geologist and mining specialist who, with his friend Fritz Frankenhaeuser, decided to try his luck in California's gold fields. In 1849 the two men embarked from Abo aboard the *Froja*, which was sailing for Sitka. There they were allowed to remain until the following year, when a Russian-American Company ship would leave for California.

Holmberg and Frankenhaeuser found no employment and no opportunities in California. In 1851 they managed to return to Sitka aboard the company vessel *Prince Menshikov*, and the new governor of Alaska, N. Ia. Rosenberg, put them to work. Fritz Frankenhaeuser was assigned to assist the geologist Doroshin in his survey of the Kenai Peninsula, while Holmberg was sent to Kodiak Island. In the summer of 1851, Holmberg traveled around Kodiak in a kayak making geological observations and collecting ethnographic materials. He used the journal he kept on his Kodiak travels and letters he wrote to the well-known geologist Grewingk as the basis for an interesting account of his findings, which was published in 1852 in the *Proceedings of the Russian Royal Minerology Society*.

During his short stay in Russian America, Holmberg collected a large number of natural science specimens, including 19,000 insects for the University Museum in Helsinki. He also acquired a substantial ethnographic collection, which included Alutiiq artifacts from Kodiak Island and Chugach items from Prince William Sound, as well as Tlingit and Aleut material.

Only a few of these artifacts remained in Finland and are included in the current exhibition. When Holmberg returned to Europe, he visited Copenhagen, met C. J. Thomsen, the founder of the National Museum of Denmark, and began corresponding with him. It is believed that it was Thomsen who persuaded Holmberg to sell his ethnographic collection to the Danish Museum.[6]

Soon after he returned to Finland, Holmberg wrote *Ethnographic Sketches on the Peoples of Russian America*, which was published in two parts in German in 1856 and 1863 (an English language edition of the book was published by the University of Alaska Press in 1965). Holmberg's contribution to Alaskan ethnography is recognized by specialists throughout the world.

Johan Hampus Furuhjelm (1821–1909) was one of the bright young men serving in the Navy who attracted Etholen's attention; on Etholen's recommendation, Furuhjelm was offered a post with the Russian-American Company. After a brief period at company headquarters in St. Petersburg, he was assigned in 1850 to Sitka, and he was governor of Alaska from 1859 to 1863.

Like Etholen, Furuhjelm is considered to have been a very effective governor, and his achievements seem even more remarkable when one considers the conditions under which he labored. He assumed gubernatorial office in a trying and uncertain time. The Crimean War, which Russia had recently lost, had left its mark on the Alaskan colony. Shortage of supplies, constant tension in

Bentwood box, Chugach Eskimo of Prince William Sound. Chugach artifacts in most Alaska collections are very seldom identified—this is a rare example of provenanced Chugach bentwood work. Photograph by Matti Huuhka, courtesy Finnish National Board of Antiquities.

6. Holmberg's collection was described in 1941 by Kaj Birket-Smith, the noted Danish anthropologist who worked in Alaska ("Early Collections from the Pacific Eskimo," *Ethnographic Studies*, Nationalmuseet Skrifter, Ethnografisk Raekke I).

Johan Hampus Furuhjelm, governor of Alaska (1859-1863) and later of Russia's Far East Maritime Provinces, in the uniform of the Russian Imperial Navy. Courtesy Finnish National Board of Antiquities.

expectation of enemy attack and Tlingit unrest (which some thought was encouraged by the British), and the collapse of the European and Chinese fur markets all contributed to the mounting pressure. But the greatest uncertainty lay in the fact that the company's charter, which was expiring in 1862, had not been renewed, and the colony was being administered on a provisional basis.

Yet Furuhjelm was not discouraged. He quickly improved relations with the Tlingit, which had deteriorated under his predecessors. He took effective steps to reinvigorate the colonial industries, attempting to diversify the economy, revitalize shipbuilding, and cope with various social problems. Under his administration the smallpox epidemic, which in 1862 was spreading from California, was effectively checked through a vaccination program.

Another worry during Furuhjelm's administration was the rush that followed the discovery of gold on the Stikine River in British territory. Furuhjelm feared that a stampede comparable to the California gold rush of 1849 might overwhelm the colony. But the Stikine gold deposits were meager, and this fear proved groundless.

Furuhjelm's service with the Russian-American Company had been frequently interrupted by recalls to naval duties, and after he left Alaska in 1863, he returned to naval service. He soon became governor of the newly acquired Maritime Provinces in the Russian Far East and was stationed at Nikolaevsk until 1870. In 1874 he was made vice admiral.

Johan Furuhjelm's brother, Enoch Hjalmar Furuhjelm (1823–1887), a mining specialist educated in Finland and in Germany at the prominent Freiberg School of Mines, joined the Russian-American Company in 1853. He is best known for development of the commercial coal mine on the Kenai Peninsula, where coal deposits had been known to exist since 1786.

The goal of the new industry was to produce coal for sale to the developing American ports in California and along the Northwest Coast. By 1859 the coal village at English Bay on the Kenai Peninsula had twenty dwellings, a church, stables, cattle yards, a warehouse, a blacksmith shop and small foundry, a sawmill, and various subsidiary structures. It was, at least temporarily, the third largest population center in Russian Alaska, after Novoarkhangel'sk and St. Paul Harbor on Kodiak Island.

The annual production of coal was 5,000 tons, but only two vessels came for the commodity, and they took on but a fraction of the total production. Because coal deposits in British Columbia were by then being worked, and coal had been discovered in California and Oregon, the costs of transporting Alaskan coal were no longer justified. The Kenai venture was unprofitable, and the mine was closed.

In 1862, Enoch Hjalmar left Alaska. He took with him a foster daughter, a ransomed Tlingit slave girl whom he named Aina Iliamna Moore (the choice of her name, especially the surname, represents a mystery). Furuhjelm traveled home via Panama and the United States, first sailing on the steamer *Golden Gate*. On July 27, 1862, the vessel caught fire off Manzanillo, Mexico, and 198 of the 338 passengers were lost. Furuhjelm was among the survivors, but most of his baggage and his natural science collections perished, and only a few specimens are represented in the exhibition.

Although they were more numerous than the professionals, less is known about the many Finns who served in Russian Alaska as sailors, dock hands, artisans, and laborers. When their service began, their names appeared in the parish registers of Helsinki and other Finnish towns as transferred to Novoarkhangel'sk parish, and when they had served their term in the colonies, their names reappeared with testimonials from the governors as to the quality of their work.

This bentwood helmet from Unalaska Island represents unparalleled achievement of Aleut artists, in painting as well as ivory sculpture. Photograph by Matti Huuhka, courtesy Finnish National Board of Antiquities.

A few remained in Alaska after it was sold to the United States. For example, Gustave Niebaum (1842–1908), who came out from Finland as a sailor, and rose to mate and captain in the colonies; after the sale of Alaska he became an American citizen and a partner in the Alaska Commercial Company. Evidence that others stayed is in the surnames of their numerous descendants, such as the Lindquists of Sitka or the Lakhtonens (the Russian spelling is Lekhtonins) of Kodiak. A member of the Lakhtonen family served in the Alaska Legislature from 1980 to 1982.

A. Altonen, one of the Finns who came to Alaska with Etholen, married into a Tlingit family and moved to Juneau in 1882. Altonen was a founder of the Pioneers of Alaska. One of his descendants recently served as Assistant Commissioner of the Alaska Department of Health and Social Services and then in the governor's office in Washington, D.C. Another Altonen descendant is currently with the Department of Education.

Many Finns accepted the offer of United States citizenship in 1867 and moved to Marin County, California, where their gravestones may be found today.

Lydia T. Black received her Ph.D. in Anthropology at the University of Massachusetts in Amherst and is Professor of Anthropology at the University of Alaska, Fairbanks. She is an expert on Aleutian history, traditional life ways, and material culture. Among her numerous publication credits is the book Aleut Art, *published in 1982 by the Aleutian/Pribilof Islands Association in Anchorage. Although she has lived in the United States since 1950, she was born in Kiev and has a special interest in Russian-American history.*

Richard A. Pierce, born and educated in California, is professor emeritus at Queen's University, Kingston, Canada, and a member of the history faculty of the University of Alaska, Fairbanks. His published works include Russia's Hawaiian Adventure, 1815–1817 *and* Eastward to Empire: Russia and the Open Frontier, Early Times to 1741. *Dr. Pierce is editor and publisher of the Alaska History series and Russia and Asia series of The Limestone Press.*

The biographical information in this article is based primarily on Dr. Pierce's two decades of research on the subject. Information on the descendants of Finns in Russian America who are active in Alaska today was provided by Alaska State Representative Niilo Koponen.

The materials sent to Finland by Etholen and his contemporaries are the subject of Gifts from the Great Land, an exhibition organized by the National Museum of Finland and the Natural History Museum of Los Angeles County and appearing in Los Angeles through April 17, 1990. A complete catalog to the materials, The Etholen Collection *(National Board of Antiquities of Finland, 1990), has been written by the exhibition curator, Pirjo Varjola of the National Museum of Finland, with contributions by Julia P. Averkieva and Rosa G. Liapunova.*

The national tour of Gifts from the Great Land is made possible by the generous support of ARCO.

The New York Times *is sponsoring the opening events for the exhibition. Nordstrom is the sponsor of the Los Angeles appearance of the exhibition.*

THE WILDLIFE PAINTINGS OF GUY COHELEACH

Guy Coheleach is one of the world's foremost wildlife artists. His earliest subject was birds, and he is noted for his dramatic renderings of birds of prey, particularly the bald eagle. Since the mid-1960s, when he developed an interest in Africa, he has been known for his compelling paintings of big cats, elephants, giraffe, and other African wildlife.

Coheleach works in many different media and with an eclectic style. His exhibitions have been taken for group shows because of this diversity, but consistent throughout his work is a sense of the individual life of each animal portrayed, whether sketched or painted in watercolor, oil, or gouache.

Coheleach was one of the first postwar American artists to have an exhibition in Peking, and prints of his bald eagles have been presented as gifts to visiting heads of state. His work has been featured in major magazines and countless exhibitions and was the subject of the enormously popular *The Big Cats* (Abradale/Abrams, 1982), a treatise on the natural history of pumas, jaguars, lions, leopards, and cheetahs.

More than 35 of Coheleach's paintings will be on display in the Natural History Museum's Director's Gallery from March 9 through August 4. While featuring a few of his most popular pieces, the exhibit will be composed primarily of new paintings on display for the first time.

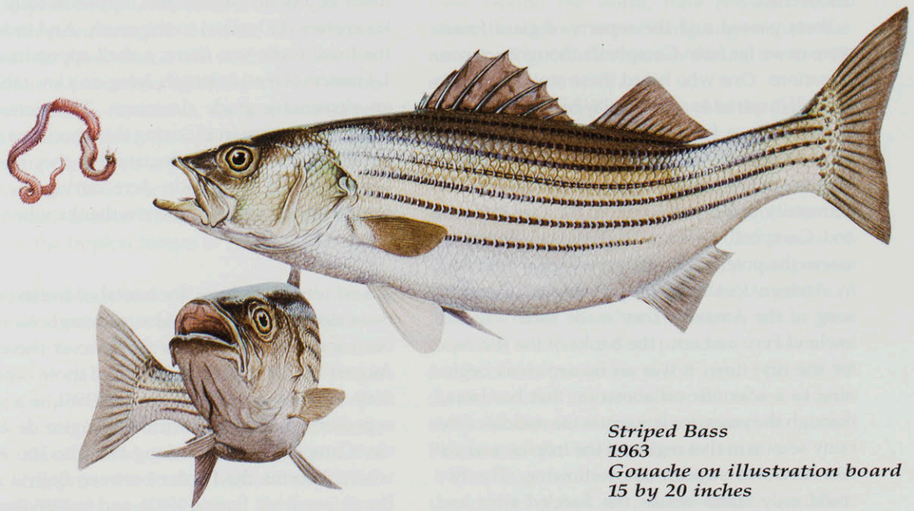
30 Yards — Closing Fast
1990
Oil on linen
24 by 44 inches

The Last Ivory Hunt
1988
Oil on linen
24 by 30 inches
Collection of Walter Johnson

Freedom
1986
Acrylic on illustration board
30 by 40 inches

Rocky Mountain Chase
1980
Oil on linen
30 by 40 inches
Collection of Ann Bishop

Siberian Tiger Head
1981
Gouache on illustration board
24 by 30 inches
Collection of Ann Bishop



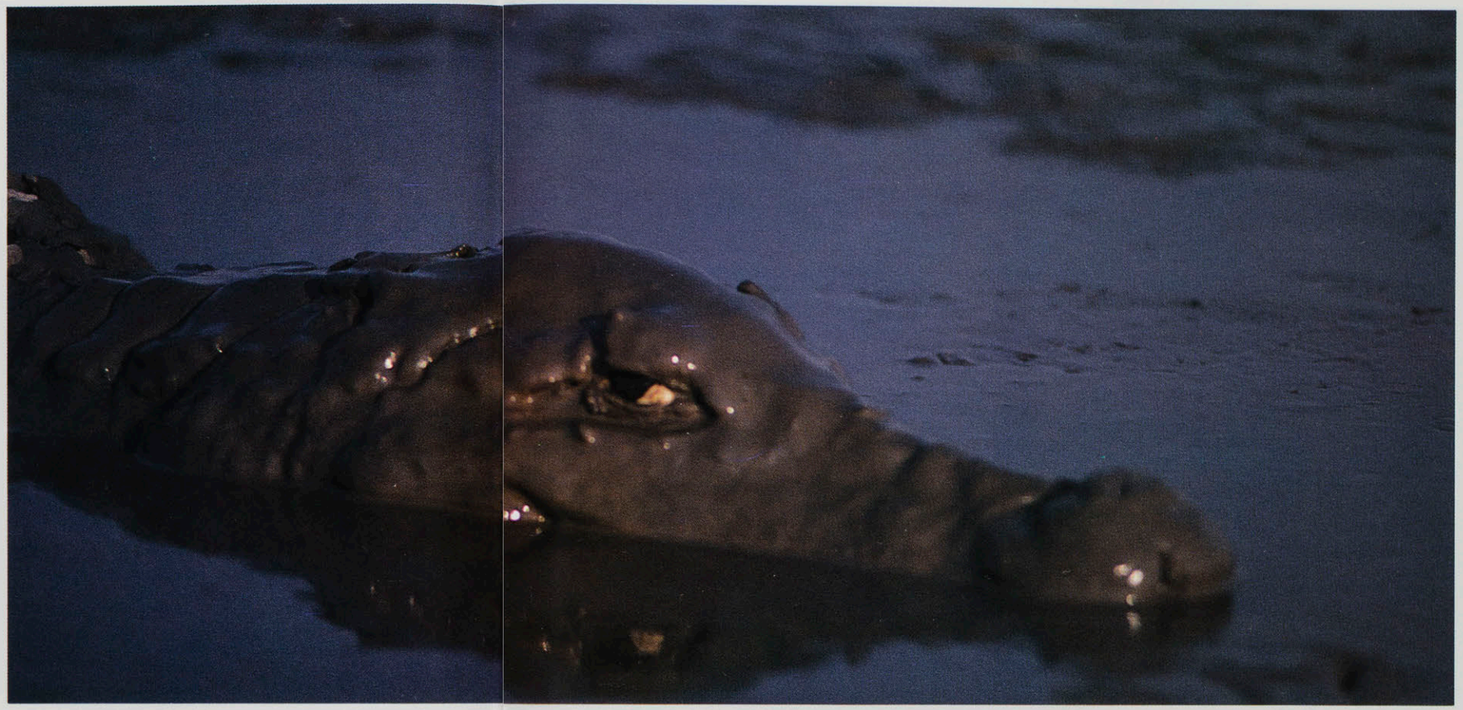
Striped Bass
1963
Gouache on illustration board
15 by 20 inches

Uncovering the Mysteries of the Amazon

Vertebrate Paleontology Reveals Creatures Great and Small

by KENNETH E. CAMPBELL

and CARL D. FRAILEY



Crocodilians are seen as rather menacing animals by most people. Try to imagine one 14 meters (46 feet) long that may have weighed as much as 18,500 kilograms (20 tons)! Cuban crocodile (Crocodylus rhombifer)*; photograph by Jeffrey W. Lang.*

In 1971, when Ken Campbell was a graduate student in paleontology at the University of Florida, an ornithological collecting trip took him to the southeastern corner of Peru, near Bolivia. As he was packing to return to Florida at the conclusion of his stay, a man approached him with tales of giant turtle shells coming out of the banks of a nearby river, the Rio Acre. He was also told, although he heard with a skeptical ear, of a place on the upper (or Alto) Rio Acre where a giant caiman skeleton stretched across the river, forming a rapids known as Cachuela Inglesa, the "English Falls." As exciting and fascinating as these stories were, there was no time to investigate because the weekly plane that provided the only transportation out of the forest was due. Campbell determined, however, to return for further study. Virtually nothing was known of vertebrate fossils from the Amazon Basin and perhaps the rumors of turtles, which were more believable than the giant caiman tale, were a clue to where more fossils could be found. It was a prophetic hunch that would lead into a lifetime of work and discoveries.

Years passed and the reports of giant fossils were never far from Campbell's thoughts or conversations. One who heard these stories and was himself inspired to see what lay behind them was Carl Frailey, a friend of Campbell's from their graduate school days together at the University of Florida. Frailey was a doctoral student at the University of Kansas when, in January 1977, he and Campbell travelled to Peru and Bolivia to assess the potential for paleontological fieldwork in Andean localities. Responding to the siren song of the Amazon, they made their way into lowland Peru and onto the banks of the Rio Acre for the first time. It was an inauspicious beginning to a scientific collaboration that has lasted through the years, for January is the middle of the rainy season in that region of the tropics, and the Rio Acre was swollen to overflowing. The two could only stand beside the flooded river and resolve to approach their search with a little more planning next time.

Before leaving the area, the men learned of a giant fossil turtle that had been taken from the river and put on display in a schoolhouse in the town of Puerto Maldonado, approximately 200 kilometers (120 miles) to the south. And indeed, the fossil turtle was there, a shell approximately 1.4 meters (4 feet) in length, lying on a low table in an elementary grade classroom. The stories of giant fossils were true! Seeing this specimen convinced the two paleontologists that they simply had to return to the Rio Acre during the dry season and investigate the riverbanks when the water was low.

And return we have, for a total of five expeditions along the Alto Rio Acre, although we have been together on only the first two of these, in August 1977 and June 1979; both of these expeditions were launched from Peru. In 1981, in a joint expedition with the Servicio Geológico de Bolivia, Campbell travelled along the Alto Rio Acre where it forms the border between Bolivia and Brazil (see *Terra*, Spring 1982), and in 1986 Frailey retraced the steps made on earlier trips along the Alto Rio Acre, where it is the frontier between Peru and Brazil, visiting all known localities and locating new sites. This expedition, as well as the most recent to the Alto Rio Acre, which was led by Campbell in 1988, was carried out in conjunction with paleontologists from the Universidade Federal do Acre, Brazil. On each of these five expeditions, plus others to different river systems in southwestern Amazonia, we have located vertebrate fossils and gained new information regarding the faunas and geological evolution of the Amazon Basin. And each trip has taught us some hard lessons about paleontological field work in the tropical forests of Amazonia.

The sedimentary rocks of western North America provide one of the best records of prehistoric life known for any part of the world. The fauna of the last 65 million years, the Cenozoic Era, is particularly well represented because of the fortunate accumulation of broad sheets of sediments in and about the rising chains of mountains that today comprise the Rocky Mountains. Within these sediments were preserved the remains of many of the plants and animals that lived in North America during the Cenozoic, fossils that are now being exposed through the processes of erosion in a dry, temperate climate. These fossils, which are studied by vertebrate paleontologists from around the world, have revealed much about the wide variety of intriguing animals that have lived in North America during the last 65 million years.

In contrast, very little is known of the Cenozoic history of plants and animals for most of South America. A quick examination of a globe and some knowledge of geography explains why this is so. In South America, a situation equivalent to that in our American West—broad sheets of Cenozoic sediments and a dry, temperate climate—can be found only in Argentina. Indeed, most of what is known about the Cenozoic animals of South America comes from fossils of this one country. The greater portion of South America lies in the tropics, where potentially fossiliferous strata are covered by water, Pleistocene alluvium, or dense forests.

The diversity and abundance of life in the tropics during the Cenozoic presumably equalled or exceeded that of temperate South America, but this has never been demonstrated by fossils. As a

Continued on p. 39

A relatively narrow portion of the Rio Acre in the dry season of 1986. At this time of year, children can easily wade through the river, but during the rainy season a torrent of water 6 to 8 meters (20 to 26 feet) deep may rage through this bend. Photograph by James Frailey.

Continued from p. 37

result, the faunal history of one of the most biologically fascinating areas on earth is also one of the least understood.

As we have travelled the tropical rivers of southwestern Amazonia in search of fossil vertebrates we have been fortunate to catch a glimpse of the area's prehistoric life. In a series of expeditions to Peru, Bolivia, and Brazil sponsored by the National Geographic Society and the National Science Foundation, we have worked together with colleagues and students in each country in an effort to discover something pertinent to the Cenozoic history of the Amazon Basin and the plants and animals that used to live there. Because we were aware of the logistical difficulties and the small successes of earlier paleontological expeditions to the Amazon, we would have felt rewarded by only small additions to the knowledge of this place and time. It has happened, however, that we have been immoderately successful in the variety, quantity, and quality of fossils discovered. These fossils, and our evolving sense of geological processes in the Amazon Basin, are leading us to new hypotheses of the origins of the Amazonian tropical forests and the amazing diversity of life they support.

The Rio Acre (AH-kray), or Acrid River in English, belies its name. It is a gentle, white-water river that originates in the lowlands of eastern Peru (not the Andes) and flows northeastward for about 500 kilometers (300 miles) before joining the Rio Purus in Brazil. During the dry season, which is the time that the fossiliferous clay banks in the bottom of the river channels are exposed, the Rio Acre winds slowly through a verdant forest rim that is broken only occasionally by small farms. In contrast, the powerful storms of the rainy season fill the river channels with turbulent water, often to a depth that is several meters (tens of feet) greater than what is seen in the dry season.

Upriver from the small town of Assis, Brazil, the Alto Rio Acre is very shallow for most of its length in the dry season, deepening only at the curves. The shallow-draft native canoes in use on the river, which are little more than hollowed-out tree trunks and thus incredibly heavy, easily glide through only a few inches of water. But there is little room for passengers. And when the river is low any significant amount of cargo will cause a canoe to ground on the sandbars or tree trunks that criss-cross the river bottom. In the dry season, the riverborne traveler spends a lot of time walking through muddy water, dragging canoes over sandbars and tree trunks.

The lowlands of the southwestern Amazon Basin, showing the Rio Acre, site of some of the most productive fossil localities in the Amazon Basin.

Most of the fossils we have found in southwestern Amazonia are late Miocene in age, about 6 to 9 million years old. (Their age was determined by comparing them with similar fossils from Argentina, where the sediments have been dated by radiometric techniques.) Miocene fossils in Amazonia are typically found in one of two distinctly different settings. In one case, the fossils come directly from the Miocene sediments, mostly clays, that form the bottoms and lowermost banks of the river channel and that are exposed only during the dry season. Usually the fossils are found as isolated individuals, but sometimes they are in what appear to be massive bonebeds, or "animal graveyards" as it were. Often, many bones from one animal are found in close proximity. These fossils are said to be *in situ*, or in the place where they accumulated at the time of death of the animal, and they have usually taken on the color of the sediments. They are thus superbly camouflaged, and close scrutiny of the riverbanks is required to find them. Indeed, after finding a few fossils *in situ* one realizes the wisdom of always walking along the riverbanks. From a canoe, at a convenient distance from the shore so as not to ground on the river bottom, the fossils would never be seen.

A large and important bonebed that crops out at the surface of the banks of the Rio Acre at Niteroi, a locality upriver from the city of Rio Branco, Brazil. During the rainy season, the riverbank and the grassy areas just above the excavation are under water. To get at this bonebed a sizeable amount of overburden had to be removed; once that was done (right) an abundant field of jumbled bones was revealed. Photographs by Ken Campbell.

When the fossils are not *in situ* they are found in a particular type of conglomeratic deposit (a deposit containing many different sizes of sedimentary particles) that lies directly upon the Miocene sediments. These fossils are said to be "reworked," having been carried from the place where they were originally preserved and redeposited in the conglomerate. Reworked deposits are relatively common, and at any outcrop one may find fossils in the conglomerate. The fossils are mixed throughout the matrix, and the bones of any given animal have usually been widely scattered. Most of the microfauna—the small rodents, primates, and fish teeth—that we have found has come from these deposits.

How the conglomerate was formed is one of the puzzles of the geology of southwestern Amazonia that we have yet to solve, and we disagree on its origin. Campbell thinks it formed as the result of a cataclysmic flood event in the late Pleistocene. Frailey thinks it is much older and perhaps formed as debris flows during the Miocene. Further field work will be required to resolve this issue, but one interesting aspect of the deposit is that all of the fossils found in it are of the same kinds of Miocene animals that are found *in situ*. We have never found fossils of a younger or older age in the conglomerate.

In fact, one of the major disappointments of our work has been our failure to find any deposits younger than the Miocene that contain plentiful fossils. We have found isolated fossils on sandbars and point bars along the river that we think are from Pleistocene deposits, and two marvelous articulated sloth skeletons that may be early Holocene in age, but we have never found any Pliocene or Pleistocene fossils *in situ*. We have been told, however, of various rivers where fossils of mastodonts, giant ground sloths, and other Pleistocene animals occur, and so it is just a matter of time and, of course, a bit of serendipity, before they are found. It is rumors like these that often fuel discoveries in vertebrate paleontology.

The fossils we have found tell a remarkable story of life in the Amazon about 10 million years ago. In the Miocene the Andes Mountains to the west were still small, just beginning their rise to the spectacular peaks they form today. Between the highlands of the eastern portion of the continent and the rising Andes to the west there existed a vast inland basin that was gradually filling with sediments eroded from the highlands. Earlier in the Cenozoic this basin was covered by a shallow inland sea that extended from the Caribbean to the South Atlantic, an inland sea that maintained a contact with the Pacific Ocean to the west until this opening was sealed by the rising Andes. The

The palate of the giant crocodilian **Purussaurus** *as it appeared when first noticed by members of the paleontology expedition; the largest tooth cavities visible are approximately 5 centimeters (2 inches) in diameter. Although only a small portion of the tooth row is visible, the palate was immediately recognizable for what it was—had some other portion of the skull been protruding from the mud the spectacular fossil could easily have been overlooked as being part of the peculiar rock formations immediately to the left of the skull. Photograph by Carl Frailey.*

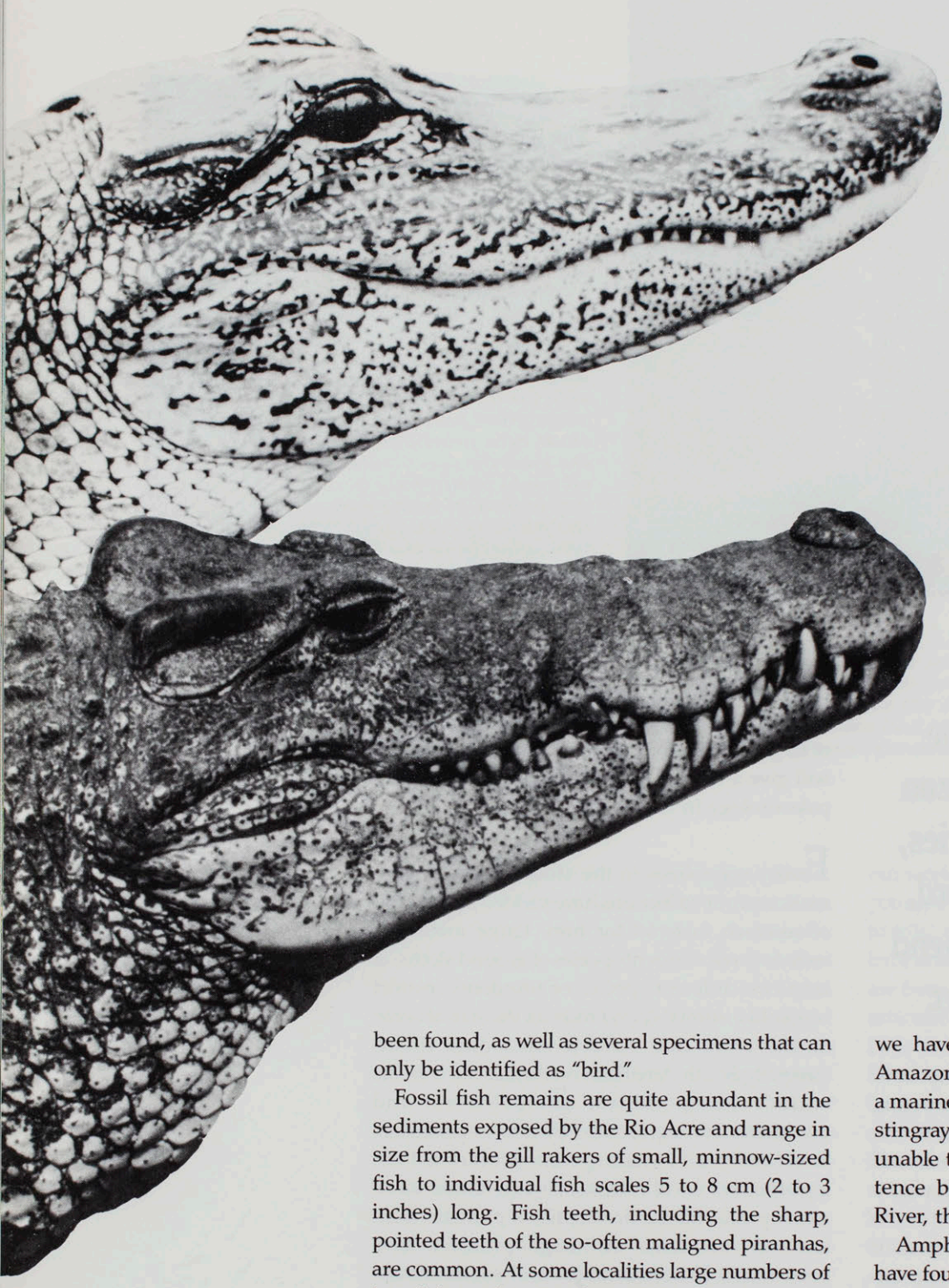
So little is known of the fossil record of the Amazon Basin that huge discoveries, in every sense of the word, may lie around the next bend of any Amazonian river.

Amazon River as we know it today may not have existed at this time or, if it did, was a very young river. As the inland sea filled with sediments, the contacts with marine waters to the north and south were lost, resulting in the evolution of a freshwater fauna. Remnants of the fauna of the inland sea persist today, however, in the form of freshwater river dolphins, crabs, and approximately fifty species of fish, including stingrays, that have close marine relatives.

To date, only the fossil mammals we collected in 1977, 1979, and 1981 have been described scientifically. The material collected in the last few years, which is greater in quantity and better in quality and variety, has just recently been prepared for study, having been cleaned of all surrounding matrix, glued when broken, and hardened to prevent deterioration in handling and storage. In one instance, matrix from a particularly productive locality was washed, first in the river and then in the laboratory, to remove all clay-sized particles, and the resulting "microconcentrate" was picked of its tiny fossils with the aid of a microscope. A brief survey of the variety of large and small vertebrates that we have found will give a hint as to the potential for vertebrate paleontology in Amazonia.

Frailey specializes in the study of fossil mammals, and our collections have yielded a great deal of research material for him. Large mammals include three different species of ground sloths, at least two different species of toxodonts (extinct hippo-like animals), and rodents the size of some of the cows that inhabit Amazonia today. Uniquely South American mammals such as the extinct astrapotheres, pampatheres, and pyrotheres are represented by a few specimens. Small mammals include specimens of armadillos, a plethora of small rodents, several mouse-sized marsupials, and the first fossils of primates from lowland Amazonia. Although primates have been found in northernmost and southernmost South America and in a high mountain basin in Bolivia, our finds are the first in the tropical regions favored by these animals today. The fact that the primate specimens came from three different localities in three different years indicates that there is a great potential for discovering more and better specimens of these early South American monkeys.

Campbell specializes in the study of fossil birds, but the collections have not favored him with many specimens. One bright spot is the discovery of several bones of a giant anhinga, or snake bird, that is almost twice the size of living anhingas. Some bones of cormorants have also



American alligator **(Alligator mississippiensis,** *top***)** *and American crocodile* **(Crocodylus acutus).** *All crocodilians of the world belong to one of three subfamilies of the family Crocodylidae, the two most important of which are the Alligatorinae (alligators and caimans) and the Crocodylinae (crocodiles).*

Most of the differences between crocodiles and alligators are not readily apparent, but one feature that can be used to tell the two groups apart is the placement of the fourth tooth of the lower jaw. In the Crocodylinae, this tooth fits into an external notch in the upper jaw and is visible when the mouth is closed (bottom). In contrast, in the Alligatorinae all teeth of the lower jaw fit inside the teeth of the upper jaw and are not visible when the mouth is closed.

Because all of the lower teeth of the fossil crocodilian **Purussaurus** *fit inside the upper teeth, it has been referred to the subfamily Alligatorinae. Photographs by Kent A. Vliet.*

been found, as well as several specimens that can only be identified as "bird."

Fossil fish remains are quite abundant in the sediments exposed by the Rio Acre and range in size from the gill rakers of small, minnow-sized fish to individual fish scales 5 to 8 cm (2 to 3 inches) long. Fish teeth, including the sharp, pointed teeth of the so-often maligned piranhas, are common. At some localities large numbers of lungfish teeth were found. Perhaps the most abundant fish remains are the teeth of stingrays, of which we must now have hundreds. Fish spines are also common: for one type of catfish we have found broken spines whose original lengths were 30 to 40 cm (12 to 15 inches), suggesting an overall body length in excess of 5 meters (16 feet).

A surprise find in 1988 was a group of four shark teeth, the only fossil shark teeth ever found in the Amazon Basin. Sharks often swim up the Amazon River today, but they never venture into its upper tributaries. The sharks that left these teeth, and the stingrays whose fossilized remains we have found, must have been living in the Amazon Basin as it was gradually changing from a marine to a freshwater environment. Unlike the stingrays, however, the sharks apparently were unable to adapt to a completely freshwater existence because, except for the lower Amazon River, they do not live in Amazonia today.

Amphibian fossils are present, but so far we have found only isolated, fragmentary bones and are unable to say much about them.

Reptilian fossils, however, are a completely different story. We have a number of fragments of tiny lizard jaws, most coming from the reworked conglomerate but still bearing teeth. Several kinds of turtles are represented in the fauna, including one giant, the jawbone of which indicates that it had a head close to 30 to 40 cm (12 to 15 inches) wide! A piece of a turtle shell that may come from the same species suggests that it was a terrestrial turtle with an overall length of over 2 meters (6.5 feet), a size reached today only by the largest of the sea turtles.

Although we had seen the large fossil turtle in

the schoolhouse in Puerto Maldonado, when we began our field work we were still reluctant to trust the tales of giant turtle fossils. We determined for ourselves that they were true, however, on our first trip up the Rio Acre in 1977, when we collected our first large turtle, which was about 1 meter (39 inches) long , and saw two more that we could not take with us. In 1979 we collected another fossil turtle of about the same size, which is currently in the Museo de Historia Natural in Lima, Peru. This specimen is particularly interesting because in life the turtle had suffered a large bite out of the right back corner of its shell, possibly losing its right hindleg in the process. The shell had healed, indicating that the turtle had survived its loss and lived for some time after the attack. As we were collecting this specimen we could not help but marvel at the size of a predator that could take a bite over 30 cm (12 inches) wide out of a turtle that was close to 25 cm (10 inches) thick.

We assumed that the predator was *Purussaurus brasiliensis,* one of the giant extinct crocodilians that had been described from Amazonia late in the last century. Unfortunately, only scattered pieces of this fossil giant had ever been found, mostly vertebrae and teeth, but everyone who examined them knew that this was a species whose members could attain thunderous proportions. In our collecting we had found at least six different kinds of fossil crocodilians, some of which look like living caimans, some like the gavials of Asia, and some that are new to science and are currently being described. We too had found isolated vertebrae and teeth of *Purussaurus,* and we had even found a piece of the upper jaw, a partial jawbone with sockets for teeth close to 5 cm (2 inches) in diameter. Nevertheless, we were not prepared for our 1986 crocodilian find, which is unquestionably the most fantastic fossil ever to come out of the Amazon and perhaps out of all of South America.

In an effort to broaden the territorial scope of our work and to increase the participation of local colleagues, we had joined forces in 1985 with Professor Alceu Rancy of Brazil's Universidade Federal do Acre. For several years Rancy had been struggling in isolation to build a program in vertebrate paleontology at his university, and he had accomplished a great deal. Nonetheless, his financial base and our logistical base both needed help, and we all saw a collaborative program as a logical course of action.

The first joint expedition of this collaboration took place in 1986, when Frailey led a field party of six back to our localities along the Alto Rio Acre. Rancy was unable to join the expedition because of scheduling conflicts, so he sent two students.

Frailey and his party were on the river for three weeks and enjoyed great success. They found and excavated an almost complete skeleton of a human-sized ground sloth, which was situated only a few meters from where we had found a similar skeleton in 1979. These skeletons are the first recovered for this small ground sloth; previously it was known only from a few isolated bones. At another of our localities they collected hundreds of bones of two types of toxodonts and several large ground sloths. A third locality, a new collecting site in the conglomerate bed, yielded a microfauna of hundreds of specimens, including fish, lizard jaws, crocodilian teeth, rodent teeth, and the second primate tooth ever found in the Amazonian lowlands.

Exhausted after the weeks of arduous digging, walking, and dragging canoes but content with their many finds, the paleontologists began the trip back home. They were no longer looking for fossils; their task now was to get out with what had been collected, something that needed to be done hurriedly if their multiple travel connections, from dugout canoe to international airliner, were to be met. Suddenly, at the end of the first day of the return trip, all that was changed. A truly unique, important, and impressive fossil lay at their feet. There, in the mud at the water's edge, lay the skull of the largest crocodilian anyone could ever imagine.

It was lying upside down with just the front of the palate visible. The palate appeared to be nearly 1 meter (39 inches) across with some teeth sockets 5 cm (2 inches) in diameter. The back of the skull was still buried in the riverbank, so its overall length could not be determined, although it was estimated to be about 2 meters (6.5 feet) long. The skull was solid and intact, with no significant breakage. We had often dreamed of finding the skull of the large crocodilian that just "had to be there, somewhere," but Frailey admits to being dumbfounded at the actual sight of the thing—and unnerved at the thought of excavating it and getting it back to civilization in the time available!

Removing the skull, which was estimated to weigh well over half a ton, was a daunting task. The riverbank over the back of the specimen was nearly 2 meters (6.5 feet) high and covered with vegetation. When the skull was completely uncovered, the excavators saw that it was cemented in place by underlying veins of calcite; it could not have been more firmly placed if it had been set in concrete. Small logs were cut to use as levers; after making several efforts and breaking several logs, the skull was finally moved. But not in one piece.

With heavy hearts, but inward relief, the field party now realized that there was no choice but to take the skull out in pieces. A single canoe, even if empty instead of laden with other fossils, could never have carried the specimen. To leave it and hope to return at some future date with better equipment, bigger boats, and more people was to invite the river gods to reclaim their treasure, as they surely would have.

Fortunately, as the skull had been slowly pried loose from the underlying rock, it had broken into pieces along invisible cracks. The largest piece required four men to carry it; two other blocks were so big it was all two men could do to carry them, one at a time, through the mud to the canoes. The breaks were clean, and no small pieces or fragments were lost; the skull would be easy to put together again in the laboratory.

Although only one canoe had taken the party upriver, two additional canoes had been rented from local river residents for the journey back, and the several pieces of the skull were dispersed throughout the canoes. Nevertheless, the new find, added to all the rest of the fossils, overwhelmed the fleet, and seemingly unending bouts of tugging canoes across sandbars, over logs, and through brush ensued. Getting the canoes across sand was never easy, but at least you could see where you were planting your feet, and you did not have to worry about creatures in the water. Not so when the vessels became stuck on submerged logs.

Logs mired in the river bottom cause the flowing water to course around them, creating turbulence and deep holes. As fishermen know, deep holes around logs are great resting places for big fish. In the Amazon they are also great places for big caimans. In these situations we have always been fortunate not to encounter a caiman that was big enough to cause us trouble, but the gnawing fear that *this time* might be *the time* was always present. Trying to find a purchase with your feet and push at a canoe while standing up to your neck in water over a great resting place for large caimans is always an innervating experience.

To someone not involved in Amazonian field work all of this must sound rather crazy, and in one sense it probably is. But for us the sobering reality is that if the river had been just 30 cm (12 inches) higher in 1986, most of the fossils found—including the giant crocodilian skull—would have been underwater and never seen. And if the science of vertebrate paleontology is to advance in Amazonia, this is how it must be done.

The giant crocodilian skull is the largest complete fossil skull of its type ever found and represents a species (*Purussaurus brasiliensis*) that may have been the largest crocodilian that ever existed. When restored with its lower jaw in place the skull is 1.5 meters long, 0.84 meters wide, and 0.55 meters high (62 by 33 by 22 inches). (Although there are casts of an equally large Cretaceous crocodile in various museums, the original specimen upon which the casts are based consists of only a few fragmentary bones, and thus the true size of that animal is unknown.) As gigantic as our find is, we know that there are larger ones out there because, in the collections of the paleontology museum at the Universidade do Acre, there is an almost complete lower jaw that is about 30 cm (12 inches) longer than the one that went with the skull from the Alto Rio Acre. The dream of finding a skull that large will keep us looking for some time to come!

How big was this crocodilian? It is possible to estimate its length by using known relationships between the length of the skull and the length of the body. For example, in the American alligator each centimeter from the tip of the snout to the back of the last upper tooth equates to approx-

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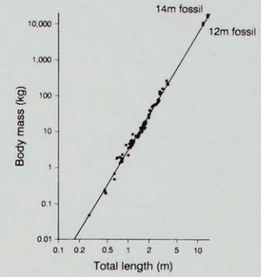
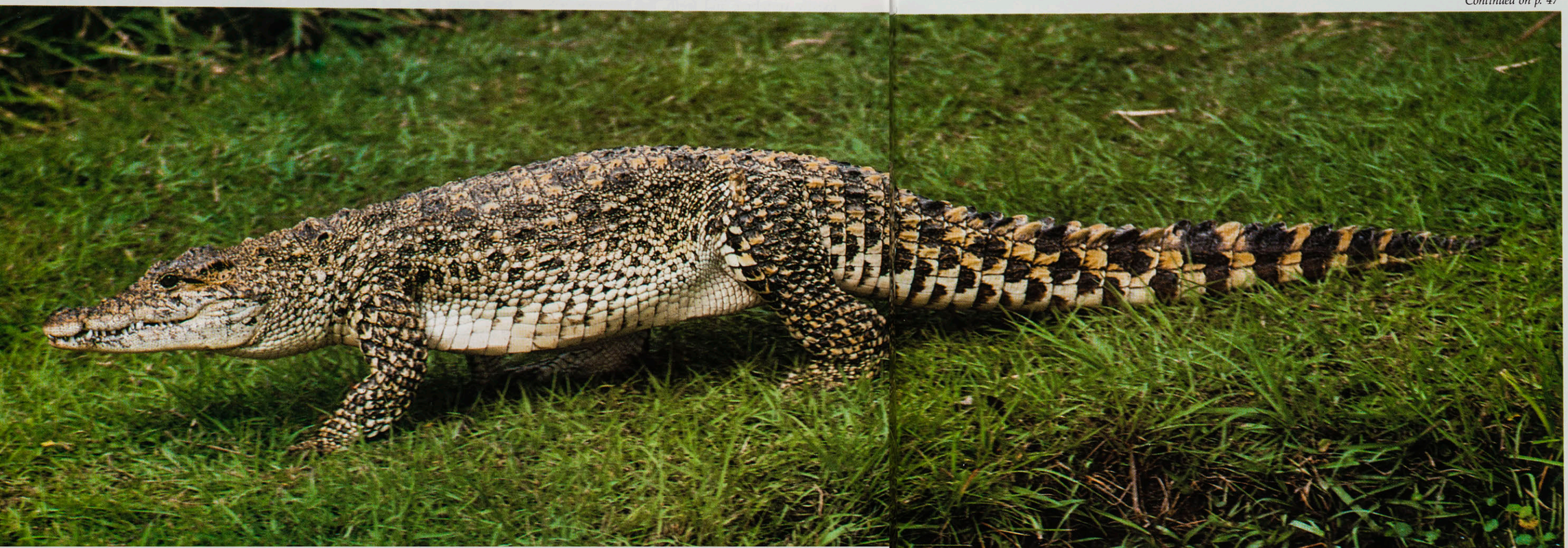


A comparison of body length and weight of 85 American alligators shows that, in this species, weight increases at a regular rate in proportion to increases in length. If the same relationship held true for* Purussaurus*, a 14-meter (46-foot) long individual would have weighed 16,250 to 18,500 kilograms (18 to 20 tons) and a 12-meter (39-foot) long individual would have weighed around 10,500 kilograms (11.5 tons). Graph courtesy of Dr. Jane Petersen.



Cuban crocodile* (Crocodylus rhombifer) *in the "high walk," a gait that more closely resembles locomotion in mammals than that in other reptiles. Note that in crocodilians the head is relatively short, representing only a very small percentage of the total body length. Ratios of skull length to body length from modern crocodilians were used with measurements from the skull of the fossil* Purussaurus *to estimate the size of the extinct animal. Photograph by Kent A. Vliet.

NOTICE
LACK OF PREPARATION ON YOUR PART DOES NOT CONSTITUTE AN EMERGENCY ON MY PART.
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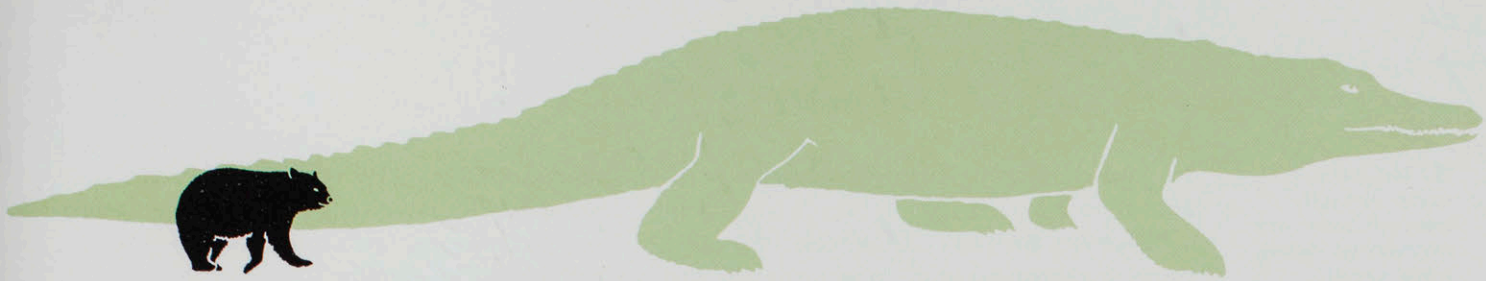

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imately 12 centimeters in overall body length. Using this 1:12 ratio and other ratios drawn from the measurements of the Brazilian skull in hand, we have arrived at a body length estimate for our crocodilian of from 11 to 12 meters (36 to 40 feet)! An estimate for the animal that produced the larger jaw on display in Brazil is 13 to 14 meters (43 to 46 feet)!

Although the length estimates are impressive indications of the size of this animal, it is also instructive to visualize the mass of its body. Most crocodilians broaden markedly in width just behind the head, and in some cases the width of the body between the front and hind legs is two or even three times the width of the skull. For *Purussaurus*, this would mean a body width of 2 to 3 meters (6.5 to 9.5 feet)! The height of the back of a crocodilian lying at rest may be more than twice the height of its head, including skull and jaws. The head of *Purussaurus* is 0.55 meters (22 inches) high, so its back probably was over 1 meter (39 inches) high when the animal was lying on the ground. It is not unreasonable to assume that, when in a normal walking pose, *Purussaurus* was over 1.5 meters (5 feet) tall.

The weight of an extinct animal is usually more difficult to estimate than its overall size (see Campbell and Marcus, *Terra*, Summer, 1990). If one assumes that the overall shape of *Purussaurus* was similar to that of an American alligator, it is possible to estimate a weight for the former by using data from the latter. Dr. Jane Peterson, who is a Research Associate in the Section of Herpetology at the Natural History Museum and on the faculty at the University of Southern California Medical School, has been kind enough to allow us to use her compilations of data on size and weight in American alligators. She has found that there is a direct relationship between the length of an alligator and its weight. Using her calculations, if *Purussaurus* were 12 meters (39 feet) long, it may have weighed between 10,000 and 12,000 kilograms (11 to 13 tons). And if the jaw in the Universidade do Acre collections did indeed come from a crocodilian 14 meters (45.5 feet) long, the animal may have weighed between 16,000 and 18,000 kilograms (17.6 to 20 tons)! At this size, *Purussaurus* would have been at least equal in size to the small sauropod dinosaur *Diplodocus*, for which weight estimates vary from 5,800 to 18,500 kilograms (6.4 to 20.4 tons).

Tyrannosaurus rex is often labeled the largest terrestrial carnivore that ever lived. The skull of *Purussaurus brasiliensis* is a little longer than the Natural History Museum's skull of *Tyrannosaurus rex*, which is 1.35 meters long, 0.89 meters wide, and 0.87 meters high (54 by 35 by 24 inches) and is the largest *Tyrannosaurus rex* skull found to date. The most recent weight estimates for *T. rex* range from 4,500 to 7,700 kilograms (5 to 8.5 tons), or far less than the predicted weight for *Purussaurus*. We know that there was one specimen of *Purussaurus* whose head was at least 30 cm (12 inches) longer than that of the museum's *T. rex*, so it would appear that the largest living terrestrial carnivore may have been a crocodilian and not a dinosaur.

Of course, some would argue that crocodilians spend most of their time, especially their dining time, in the water and that therefore they are aquatic carnivores. But this is a semantic argument. The largest aquatic carnivore known is considered to be the extinct great white shark, *Carcharocles megalodon* (formerly known as *Carcaradon megalodon*), which is estimated to have reached a length of 14 meters (45.5 feet). *Purussaurus* may very well have been larger than *Carcharocles* and thus could be the largest carnivore that ever lived, aquatic or terrestrial!

One must be cautious in estimating the size of extinct animals. The skull of *Purussaurus* is completely unlike the skull of any living crocodilian, so there is no guarantee that ratios of skull to body length or body length to weight observed for American alligators hold true for this Amazonian giant. For example, the skull of *Purussaurus* is much more massive than that of an American alligator. If this massiveness carried throughout the body, *Purussaurus* would have been much larger, or at least heavier, than estimated. Also, there are no living crocodilians that reach the size of *Purussaurus*, so we have no way of knowing if the ratios observed in the largest American alligators would remain the same if the animals were twice or three times their actual size. The only way to accurately determine the body size of

To grasp the immensity of* Purussaurus *it is helpful to compare it to a more familiar animal, in this case, a black bear, which is 1.5 meters (5 feet) long and stands 1 meter (3 feet) tall when on all fours. If* Purussaurus *were able to move in the "high walk," as shown here, it may have stood 2 to 2.5 meters (6.5 to 8 feet) tall.

Opposite: Michael Stokes (left) and Ken Campbell in the Vertebrate Paleontology laboratory with a cast of the skull and jaws of* Purussaurus, *the giant fossil crocodilian from the Amazon. The skull was prepared and cast by Stokes. The right lower jaw, also prepared and cast by Stokes, is from an individual of the same species from a different locality that just happened to be a reasonable match in size to the skull. The left lower jaw was fabricated and cast using the right as a model. Stokes modeled the teeth, all but a few of which were missing from the actual specimen, after a series of isolated teeth that had been found in the course of several expeditions. Photograph by Dick Meier and Don Meyer.

As we have seen, not all crocodilians are menacing. Some have great stories to tell! Morelet's crocodile* (Crocodylus moreleti); *photograph by François Gohier.

Purussaurus is to find a complete skeleton of the animal.

Remember the story of Cachuela Inglesa? A complete caiman skeleton, so we were told, that stretches across the Rio Acre and forms rapids large enough to stop a canoe? Perhaps there is more fact than fantasy to that tale. We have never been able to travel far enough up the Alto Rio Acre to reach Cachuela Inglesa, but perhaps it is worth another try. For now our goals are to excavate fossils at some of the proven bonebeds and to search for new localities in other parts of Amazonia. Scattered throughout the tropical forests of the Amazon are endless numbers of fossils of unknown animals waiting to be found, and we will keep looking. We have found the fossils of over two dozen animals previously unknown to science and established the basis for new interpretations of the geology of the Amazon. We hope to multiply these achievements in the future—and to bag a few more giant crocodiles along the way.

The original *Purussaurus* skull was brought to the Natural History Museum for preparation and casting in 1989. It will return to the Universidade do Acre, but Michael Stokes, Senior Museum Technician at the Natural History Museum, has prepared a superb cast of the specimen that will remain for all our museum's visitors to see and admire.

Paleontologists at the Natural History Museum have always worked in conjunction with institutions and colleagues in the countries in which we have carried out our expeditions. In some countries this is required by law, but it is everywhere a matter of professional courtesy and common sense. As scientists, we are above all interested in the development of our scientific discipline, and we welcome any opportunity to advance vertebrate paleontology. Sometimes this may mean that we provide unobtainable preparation and laboratory supplies to institutions in other countries or give training in laboratory preparation or field excavation techniques; in return, we receive access to collections in host countries, assistance with arrangements for travel in remote areas, invaluable information from local experts, and the opportunity to work with host scientists. The exchange of ideas with our hosts is always a great source of pleasure, and some of our finest times have been the evening scientific discussions around a campfire.

Most South American countries, unlike the United States, have laws restricting the exportation of vertebrate fossils, and export permits are required for removing specimens. These laws were instituted to stop what was viewed as the stealing of valuable resources by unscrupulous imperialists from developed countries (unfortunately true in some cases), but most have provisions for cooperative projects with foreign scientific institutions. The laws were developed to stop the pillaging of a resource, not to deny the development of a science.

Normally under these laws, all unique specimens, all those that are used to form the basis of description for new species, and all those of exceptional exhibition quality must remain in or be returned to the country of origin. The more common fossils may be divided between the host institutions and the foreign institutions sponsoring the expeditions—providing the latter institutions want them (and most museums do). We think these rational natural resource laws encourage the development of the paleontological sciences throughout South America.

Kenneth E. Campbell is a Curator of Vertebrate Paleontology at the Natural History Museum, where he is responsible for the fossil bird and dinosaur collections. His research interests are divided between the study of fossil birds and the geological history of the Amazon Basin.

Carl D. Frailey teaches biology and geology at Midland College, Midland, Texas, and is a Research Associate of the Vertebrate Paleontology Section of the Natural History Museum. His research interests center around the development of the mammalian fauna in the New World and the geomorphology of the Amazon Basin.

Interested in joining the hunt for giant crocodilians? Do you wish to see the Amazon forest in its primeval state? Ongoing paleontological expeditions to the Amazon Basin provide the opportunity for a select few of the Natural History Museum family to participate in a once-in-a-lifetime experience. However, these expeditions are not for the faint of heart, and they are very demanding. For more information, write to Dr. Campbell at the Natural History Museum.

THE WILDLIFE OF ANTARCTICA: PAINTINGS BY WILLIAM STOUT

Antarctica, which today plays a vital role in the earth's climate and weather patterns, was once a land of temperate forests where dinosaurs flourished and where over the centuries ichthyosaurs, plesiosaurs, and giant penguins swam in the surrounding waters. Although it is an icy domain today, Antarctica's abundant wildlife still includes whales, penguins, seals, and seabirds. The Natural History Museum's exhibit featuring 45 paintings by William Stout seeks to raise public awareness of the unique beauty of Antarctica, its natural history, and its delicate and sensitive ecology.

William Stout, an award-winning illustrator and designer, had been interested in Antarctica for some time when he noticed a consistent theme in his readings. Repeatedly, photographers stated that there was no way to capture the colors of Antarctica with a camera. Nor was it possible to describe them in words. To say that the rocks were of exquisite, unearthly shades or that the light was incredibly beautiful was unsatisfactory. "[The photographers] saying that they just could not capture the colors made me tremendously interested in seeing [Antarctica for] myself," Stout says.

It was also "the most remote, unexplored place, the closest one could come to visiting another planet and still be on earth," he says.

"You'll discover the limits of photography," he was told by those who had been there, and they were right. "On the shores," says Stout, "are sea-washed rocks, smooth and round, and they are so delicately colored—lavender, green, turqoise. When I got home and developed my photos of them, they all came out gray. And I tried all kinds of things to get the color, filters and different exposures...I have guessed, but I don't know, that the [unique] light is formed by the sun refracting through ice crystals, making prisms."

Stout made watercolor sketches and used them for reference when he got back. He was afraid to use oil, not knowing how it would perform in the cold. Nor was he sure how watercolor would function. An artist who painted extensively in Tibet gave him a tip about using watercolors in cold climates: he took some of the little bottles of liquor he had saved from his plane trip and mixed vodka with the water. The alcohol kept the paint from freezing, and the sketches were successful models for Stout's Antarctica paintings.

"In several of the pieces," he says, "I nailed the colors dead-on... the Antarctic sunset, with violet icebergs and an orange and green sky. There is a romance about the place; I'm really glad that people can see some of the color and spectacle of Antarctica in this exhibit."

The 1959 Antarctica Treaty, which placed the continent under the protection of an international body, will end in 1991. The treaty, signed by 12 scientifically active nations, has superseded all territorial claims, established Antarctica as a nuclear-free zone, and provided all nations freedom of scientific inquiry while obligating them to share their results with other countries. Observers and activists such as Stout would like to see the treaty end in the formation of the world's first international park, with activities such as mining, hunting, and oil exploration forbidden. "Antarctica is far more than just a bunch of ice and snow," he says, and he hopes his Antarctica paintings—of both prehistoric and modern species—reveal a diversity of life that is worth saving.

The Natural History Museum's exhibition of Stout's work, Dinosaurs, Penguins, and Whales: The Wildlife of Antarctica, will remain on display in the Foyer until June 23, 1991, after which it will begin a national tour.

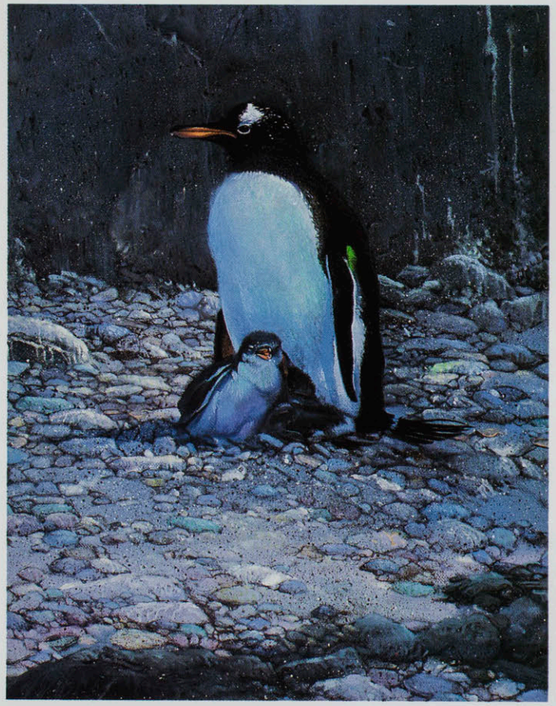
Fantasia Antarctica
1991
Oil on canvas
48 by 60 inches

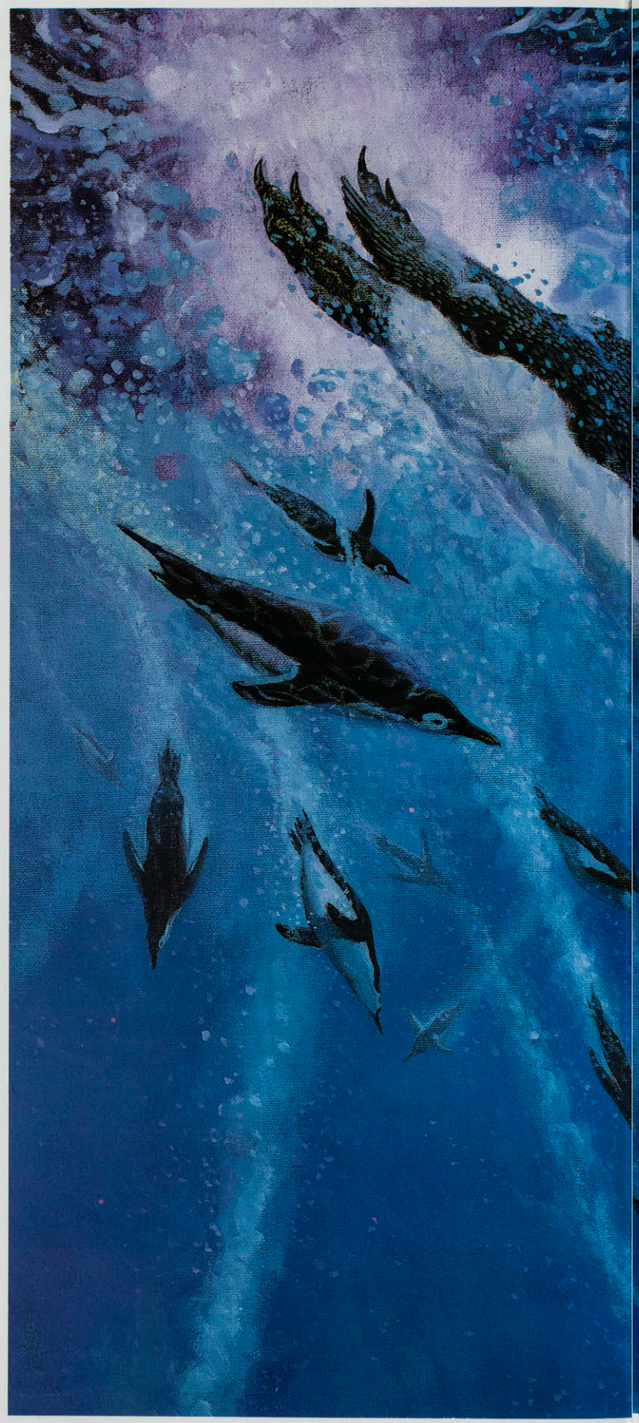
Giant Penguin
1989
Oil on canvas
24 by 36 inches

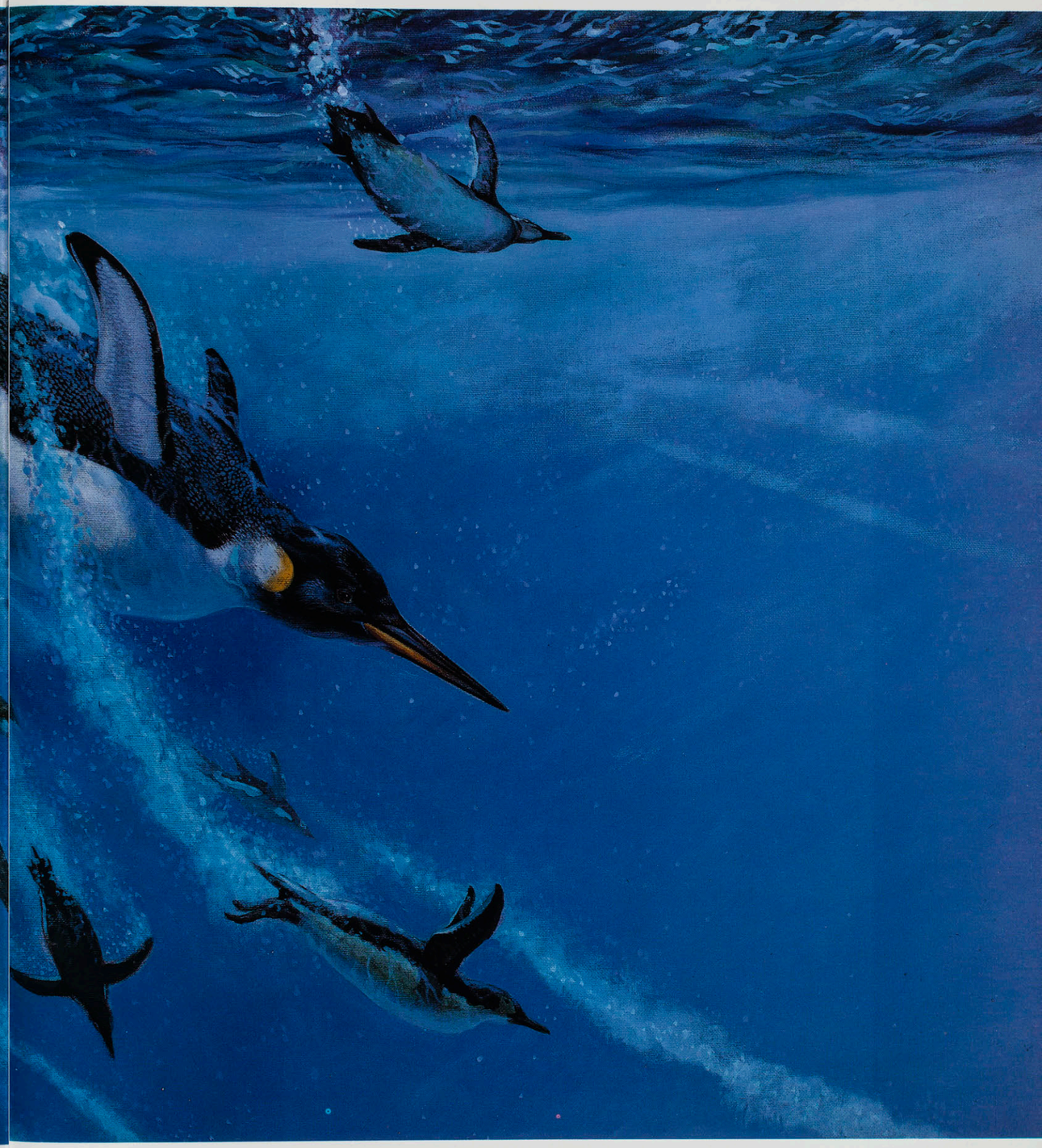
Pictured are small penguins of the Eocene period of Antarctica (about 50 million years ago), when the shallow seas around the continent were much the same temperature as the waters off of Santiago, Chile, today. Disturbing their dive is a giant penguin, known from fossil remains to have been over 5½ feet tall. This bird is similar to today's Emperor penguin except for its much longer feet and legs. Its beak was extremely long, and, unlike those of King or Emperor penguins, was not curved but straight and stork-like. The smaller Eocene penguins were quite similar to modern ones except for their beaks, which were about twice as long. (Scientific consultant: Judd Case, University of California, Riverside.)

Below: Gentoo Penguin
1990
Oil on canvas
14 by 18 inches

At 13 to 17 miles per hour, Gentoos are the fastest swimmers of all birds. They feed mainly on fish and krill, and can dive to depths of over 300 feet. Gentoos lay two spherical eggs that are incubated by both parents for 35 days. Skuas, giant petrels, sheathbills, and sometimes gulls take eggs and poorly guarded chicks. Although the main predator of the Gentoos is the leopard seal, they are occasionally the victims of sea lions. (Scientific consultant: Kimball Garrett, Natural History Museum of Los Angeles County.)

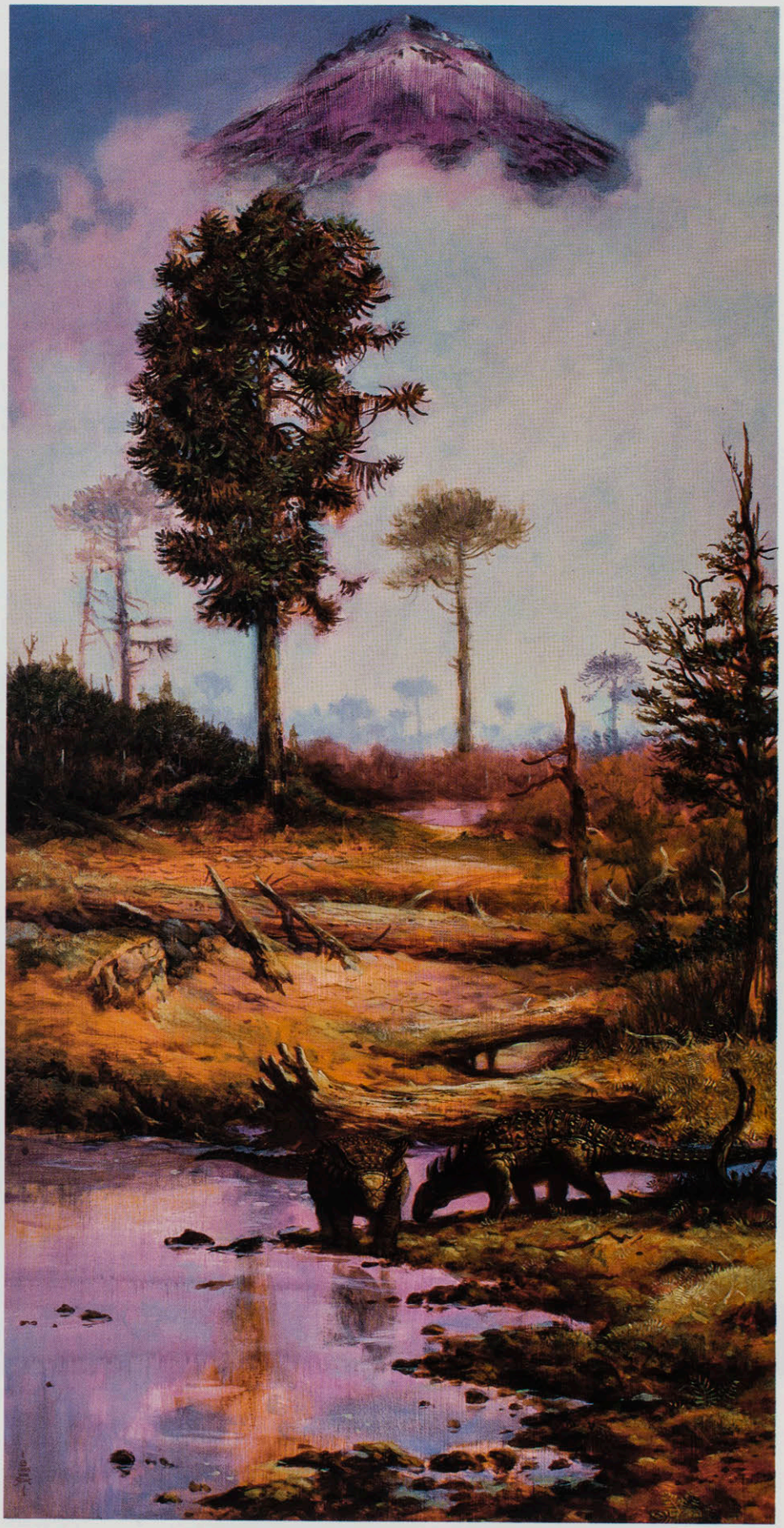






Lystrosaurus
1989
Oil on masonite
15 by 30 inches

This heavy-set herbivorous reptile thrived some 245 million years ago during the Lower Triassic Period. Like other dicynodonts, **Lystrosaurus** *had turtle-like jaws adaptable to both grubbing and foliage-shearing.* **Lystrosaurus** *had a very wide geographic range; in addition to Antarctica, it has been found in South Africa, India, China, and the U.S.S.R. The discovery in Antarctica of a species of* **Lystrosaurus** *previously known from South Africa was of great paleontological significance, as it provided evidence of the ancient continent of Gondwanaland and supported the concept of continental drift. (Scientific consultant: Edwin H. Colbert, Museum of Northern Arizona.)*



Left: Nodosaurs
1989
Oil on masonite
15 by 30 inches

The heavily armored nodosaur lived during the late Cretaceous, about 70 million years ago. A herbivore, it cropped soft ground plants with its broad beak. Like rhinos and many large modern reptiles and mammals that appear bulky and sluggish, nodosaurs, when aroused, could probably move on their powerful limbs with unexpected speed and agility.

The tall trees in the background are araucarias (monkey puzzle trees); in the foreground stand **Nothofagus** *species (southern beeches). Although only fossil remnants of these trees remain in Antarctica, they are still found in the southern regions of Australia, Africa, and South America, providing further evidence that during the late Cretaceous, these continents formed one large one. (Scientific consultant: Kenneth Carpenter, Denver Museum of Natural History.)*

Right: Mosasaur and Loons
1989
Oil on canvas
24 by 36 inches

Mosasaurs frequented the then-shallow seas of Antarctica during the Late Cretaceous, the last period of the dinosaurs. Mosasaurs were not dinosaurs but giant sea-going lizards. With their streamlined bodies and paddle-like limbs, they were well-adapted to life in the sea. A large mosasaur could grow to a length of over 45 feet on its diet of sharks, bony fish, and other mosasaurs. (Scientific consultant: J.D. Stewart, Natural History Museum of Los Angeles County.)

A VISIT TO THE TAR PITS

A cat is just a cat. But the dire wolf may have been the direct ancestor of the beagle.

by SNOOPY

A funny thing happened to me on the way to my 40th birthday party in Exposition Park.

At the suggestion of my brother Spike in Needles, I stopped by the Page Museum to have a look at the remains of their biggest cat. He made the Cat Next Door look like a gerbil. I pumped those people at the Page for all they knew about him.

Whoa, you say. Why this interest in cats? You thought I couldn't stand cats?

Of course I can't stand cats. The first thing I remember learning at the Daisy Hill Puppy Farm is that cats are the crabgrass on the lawn of life.

However, it pays to know your enemy. The facts I learned on my first visit to the Page will enable me to hate cats much more intelligently.

This reconstructed bag of bones I saw there was named Smiley, a saber-toothed cat they dug out of the tar pits next door. His saber teeth are nearly six inches long. Imagine how ridiculous he looked when he smiled like a Cheshire.

Smiley may have been trying to frighten other animals by imitating the Komodo dragon, those big lizards that roamed the East Indies. They have the same sort of saber-shaped teeth. I doubt if he fooled anyone; my imitation of a vulture shows far more acting potential.

These oversized pussycats got to be the size of a pony, but they were an also-ran in the biological sweepstakes. *Smilodon californicus*, as the scientists called them, were only the second most common fossil found in the La Brea asphalt deposits.

First prize for the largest number of skeletons recovered were those of the dire wolves. I'm not too sure what a dire wolf is. Dire means dreadful, horrible, calamitous, or terrible–those are probably just a few of the names the cats called them. But the dire wolves evolved, and in my opinion they may have been the direct ancestors of the beagle.

Paleontologists at the Page Museum say that dire wolves almost certainly were social animals that hunted cooperatively to some extent. Can't you imagine a pack of them on a clear night, baying at a Pleistocene moon, then rushing off to round up a bunch of those cats and to chase them into the tar pits? Ah, the bonhomie of the beagle!

Those cats were second class in every way. They don't even rate their own nomenclature. Do you know what scientists call those long saber teeth? Canines!

As teeth go, the sabers were rather silly. What they could do, however, was to punch two holes in the flesh of their prey while their front incisors cut a deep serration on a line between the holes. This enabled the grandmothers of the cat pack to "tear along the dotted line" for an easy morsel. I have to be even-handed: it seems the saber-toothed cats did look after their senior citizens.

It wasn't enough to save them, however. They made it through only two epochs. Thus the dog–intelligent, loyal, brave, and noble–won out in the evolutionary struggle against Smiley and the big cats with the frightening teeth.

Of course, there are still some stunted feline sub-species around that are kept as house pets by those who are not particularly interested in intelligence, loyalty, bravery, and nobility.

It would be ungallant of me not to admit that cats do have a slight role to play in modern life. In 1520, the English writer Andrewe put it best: "The catte is an onclene beste, and a poyson ennemy to all myse."

Shakespeare summed it up in *Hamlet*: "The cat will mew, and dogge will have his day."

Think about it: have you ever heard of a cat who went to a museum to study dire wolf skeletons?

I rest my case.

Snoopy, author of It was a Dark and Stormy Night *and* Theology and the Dog, *has a leading role in the comic strip "Peanuts," which appears in over 2,300 newspapers in 68 countries.*

The Natural History Museum is marking the 40th birthday of "Peanuts" with a major retrospective of the work of Charles Schulz, on exhibit in the Governors Gallery through February 17, 1991. The exhibition is sponsored by Metlife.

The author thanks William A. Akersten for sharing his ideas on saber-tooth form and function.

Pleistocene landscape reconstruction by Mary Butler.

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including Contributions in Science, Science Series, and Baja California Travels Series.

Hink was geography editor for four years for *Funk and Wagnall's New Encyclopedia* in New York City, and he held the same position at *Academic American Encyclopedia* in Princeton, New Jersey, for three years. Prior to joining the museum staff, he was editor of technical publications for Allied-Signal Aerospace in Los Angeles for seven years. He received his B.A. degree from Bucknell University in 1970 and his M.A. from Columbia University in 1972.

CURATORIAL STAFF MEMBERS PROMOTED. The Natural History Museum is pleased to announce the promotion of several scientists among its curatorial staff.

Robert L. Bezy has been promoted from Associate Curator to full Curator in the Section of Herpetology. His research focuses on the systematics of lizards and uses information from various levels, including morphology, scale microstructure, chromosomes, and biochemical genetics. His field work has been concentrated in the southwestern United States, Mexico, and Central America, but he has also worked in Kenya, Namibia, and Botswana.

Dr. Bezy received his Ph.D. from the University of Arizona in 1970 and joined the curatorial staff of the Natural History Museum that same year.

Sarah B. George has been promoted from Assistant to Associate Curator of Mammals. She has conducted research on the evolution and biogeography of shrews, and she is currently using protein variability in groups of California shrews, harvest mice, and island foxes to assess evolutionary relationships and to identify populations that are genetically unique and in need of special conservation efforts.

Dr. George served as Head of the museum's Mammalogy Section for several years and is an adjunct assistant professor of biology at the University of Southern California and adjunct at the University of California, Los Angeles. She received her Ph.D. from the University of New Mexico, Albuquerque, in 1984.

Gordon L. Hendler has been promoted from Associate Curator of Invertebrates to full Curator. He is an expert on echinoderms (starfish and their relatives) and has published extensively on their ecology, behavior, and systematics. His recent research has focused on the physical basis and biological significance of light perception in these familiar but poorly understood organisms and on their previously unexplored swimming behavior.

Dr. Hendler received his Ph.D. from the University of Connecticut in 1973 and held postdoctoral appointments at the Smithsonian Institution and at Woods Hole Oceanographic Institute. He is adjunct professor of biology at the University of Southern California.

Joel W. Martin, an authority on Crustacea, has been promoted to Associate Curator in the Invertebrate Zoology Section. He is studying the morphology and systematic relationships of a group of primitive freshwater crustaceans called clam shrimp and has published many papers on South American freshwater lobsters and on the usefulness of larval crab stages in understanding the evolution of crabs.

Dr. Martin received his Ph.D. from Florida State University in 1986. He has been recipient of several grants from the National Science Foundation, most recently, to support morphological and molecular studies of Crustacea.

FIELD TRIP OPPORTUNITY

CHRISTMAS ISLAND IN JULY. Would you like to band boobies, weigh frigatebirds, and get a great tan, all on an exotic coral atoll in the middle of the Pacific Ocean? Betty Anne Schreiber, Research Associate in the museum's Ornithology Section, has been studying the birds of Christmas Island since 1979 and needs volunteers to go along to help in July 1991.

Tropicbirds, frigatebirds, boobies, terns, and petrels nest by the thousands on this 250-square-mile atoll where 2,000 Micronesians also live. It's a chance to go to one of the most remote areas of the world and assist in a fascinating research project, which is proving that birds can predict the weather sooner than we can. (See TERRA, Summer 1990.)

Expenses for the 2-week trip, including roundtrip transportation from Los Angeles, will be about $2,700. Please call Betty Anne Schreiber at 213/744-3366 for more information.

ACKNOWLEDGMENTS

The TERRA editors thank the magazine's Editorial Board members and the following people for special assistance in preparing this issue.

Russian America and the Finns Pirjo Varjola, Finnish National Board of Antiquities. Donald Chaput and Margaret Ann Hardin, Natural History Museum of Los Angeles County. Susan Kaplan, Peary-MacMillan Arctic Museum, Bowdoin College.

The Big Trees Donald Chaput and Gary D. Wallace, Natural History Museum of Los Angeles County. Philip W. Rundel, University of California, Los Angeles. Marcia Roberson and Robert Mackinlay, Mountain Light.

Uncovering the Mysteries of the Amazon John W. Wright, Natural History Museum of Los Angeles County. George R. Zug and Charles A. Ross, U.S. National Museum of Natural History.

A Visit to the Tar Pits George H. Pipal, United Media. Eve Dutton, Determined Productions, Inc.

Focus On The West

Leg of lamb for 16¢ a pound, hams at 12¢ a pound, and a pound of hamburger for a nickel! Amazing by today's standards, but these were the going rates when Carder & Hess celebrated its "Big Opening Sale" on December 16, 1932. Produce prices were equally good: fancy Jonathan apples at 3¢ a pound, potatoes priced at 15 pounds for 15¢, and five pounds of grapes for just 5¢. Avocados, selling for $1.89 each in December 1990, were 10¢ each in December of 1932.

Produce not grown in California was more expensive. Pineapples were 35¢ each and cranberries brought from the East Coast for the holidays were 10¢ a pound.

John B. Carder and Clifton F. Hess had owned their own stores independently before the Depression hit. In 1931, they joined forces at 247 North Larchmont with the Larchmont Pure Food Market; for this grand opening in 1932, the store's name was changed to Carder & Hess.

But this was the Depression, and despite an impressive selection at what seem bargain prices, there were too few customers. In 1934, Carder & Hess became a smaller store, and in 1935 it closed for good.

John M. Cahoon
Collections Manager
Seaver Center for Western History Research

Focus on the West: Images from the Seaver Center *is a* TERRA *feature that presents the photographic highlights of the museum's Seaver Center for Western History Research. The Seaver Center is rich in photographs and other materials relating to the history of the American West.*

SOUTHLAND DIORAMA

WESTERN FENCE LIZARD

The Western Fence Lizard *(Sceloporus occidentalis)* was formerly abundant and widespread throughout much of southern California. Where near-natural habitat remains, these lizards can still be seen perched on logs, tree trunks, rocks, walls, and fence posts. The species occurs in an unusually wide variety of habitats from coastal chaparral and oak-grassland to montane coniferous forest, from Washington state to northern Baja California and east to Utah. Adults have a body size (exclusive of the tail) of 5 to 9 cm (2 to 3½ in.). Identifying features include the presence of overlapping, coarse, keeled, sharp-pointed scales; yellow markings on the backs of the limbs; and a large blue patch on the throat and on each side of the belly. As a result of the last characteristic fence lizards are often called "bluebellies," a name erroneously associated with being venomous. Lizards with blue belly patches, including the Western Fence Lizard, are harmless.

The blue patches are particularly vivid in males and are important in behavioral displays that are used for both courtship and territorial defense. For example, a male responds to the intrusion of another lizard into its area by performing a series of "push-ups" or "bobs" during which the belly and throat may be extended so that the blue patches are clearly visible. If the other lizard is a female in breeding condition she may remain motionless and permit the advances of the male. If the intruder is another male and does not retreat as a result of these threatening postures, a chase and fight may ensue.

Upon emerging from its overnight retreat, the fence lizard is very dark, and on a cool morning may be nearly black. As it basks in the warm sunlight, its body temperature rises and its color lightens. For much of the day it remains perched at a favorite vantage point, waiting for insects and other prey to move into its field of view. It then makes a rapid dash, seizing the prey, usually with a flick of the tongue. Ants, termites, and beetles are major food items.

At lower elevations in southern California these lizards are active most of the year, hibernating only during the coldest days of winter (December–January). The breeding season extends from March to July; larger females may lay up to three clutches per year, each containing 4 to 16 eggs. The eggs are elongate, with flexible white shells. They are laid in burrows excavated in damp soil. The young hatch in 8 to 10 weeks, reaching sexual maturity in less than a year and surviving for up to five years. Fence lizards are preyed upon by an array of snakes, birds, and mammals.

Although the Western Fence Lizard is one of the more persistent members of our fauna, it has been gradually eliminated from many areas in southern California where native habitats have been converted to farms, housing tracts, and cities. Fortunately, samples of these lizards are preserved in the Natural History Museum's research and reference collections of amphibians and reptiles. These samples constitute an irreplaceable resource for biologists and conservation organizations in determining the former distribution and variations of the populations in the region, as well as in monitoring the continuing decline of our natural diversity.

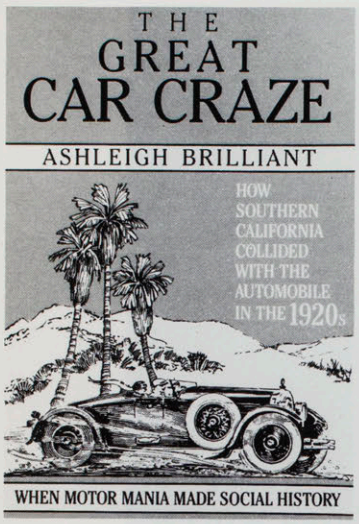
Robert L. Bezy
Curator
Section of Herpetology

JOHN DE LEON

JOHN DE LEON

***Southland Diorama** is a new TERRA column that highlights the incredible diversity of animal and plant life still to be found in southern California. Each issue will feature an example of one of the many species—extant and extinct, native and introduced, abundant and endangered—that are found in astonishing variety in and around one of the world's largest urban centers.*

BOOK REVIEW



THE GREAT CAR CRAZE: HOW SOUTHERN CALIFORNIA COLLIDED WITH THE AUTOMOBILE IN THE 1920s, by Ashleigh Brilliant, Woodbridge Press, 1989, $19.95.

Cartoonist and writer Ashleigh Brilliant turns his attention in a more serious direction in this recent volume dealing with the impact of the automobile on the social life of southern California in the decade following World War I. *The Great Car Craze*, written initially as a doctoral thesis at U.C. Berkeley in the early 1960s, offers fascinating insights into the immense popularity of the automobile in and around Los Angeles during the Jazz Age. In this brief study, Brilliant sidesteps the dreary lexicon of car companies and production statistics often covered in automotive histories, and instead concentrates on the social habits bred by the widespread use of the automobile. The result is a delightful account of the intriguing, often bizarre symbiosis of car and human that created twentieth-century southern California's transportation culture.

In the three major divisions of the book, entitled Man, Machine, and Land, Brilliant probes those aspects of the "car culture" that bear most directly on the human condition: rites of passage, status, morality, individuality. He sketches a burgeoning Angeleno self-image stemming from the notion of southern California as the automotive capital of the western world. In the Twenties, worship of machine technology unfolded as a national phenomenon, and in the seemingly limitless expanses of the west, automobiles appeared as the perfect union of American inventiveness and independence. Brilliant's explication of the passionate 1920s affair between southlanders and their cars affords a deeper understanding of how public transportation facilities later degenerated, and why southern Californians have mulishly resisted objective reappraisal of their automania.

Not that mixed feelings were totally absent from the Twenties social environment. Conservatives railed against the petro-guzzling highway monsters, while moralists decried backseat teen-age knavery. But ambivalence (sports columns fulminating against "roadway maniacs" shared news space with enthusiastic announcements of local motor races) inevitably yielded to acceptance, and the automobile became the mechanism for self-expression.

The Great Car Craze chronicles the penetration of "auto-think" into the Twenties mentality; for example, cartoonists began to depict political issues as mechanistic, through the symbolism of the automobile. Conversely, early car owners imbued their autos with biological qualities as a carryover from the horse and buggy days. One woman vowed that somehow the family car had purposely foiled her husband's attempts to whip it into submission because, "the car likes me best. I never swear at it" (p. 13). Thus the automobile consumed both mind and body.

Brilliant describes the scramble of law-enforcement officials and social institutions to deal with mushrooming problems of safety, road construction, and licensing. In fact, chaotic regulation sometimes resulted in the licensing of drivers who suffered from serious psychological and physical disabilities. On the lighter side, the author credits the onset of the Auto Age with initiating a new social role for law enforcement, where police officers appeared in public schools as quartets singing the praises of driving safety.

Brilliant also examines the coupling of the automobile and the other leading technological innovation of the age—movies. In staging some of the more memorable comedy of the Twenties, the cinema exploited the excitement and popularity of autos. Harold Lloyd, Charlie Chaplin, and Laurel and Hardy all used the automobile as a standard prop, while the Keystone Kops achieved prominence almost exclusively via the automobile genre. Use of the automobile as a comedy device met with wider popularity as traffic fatalities mounted, a development sometimes viewed as a harbinger of current insensibility to media violence.

Encroachment of the car culture is documented in the classified ads of the era: in 1919 real estate listings began to include specific mention of garages; by the early Thirties, they were routine. Space priorities in the home also changed with the growing presence of the automobile. As garages expanded, bedrooms shrank and guest rooms disappeared, partially displaced by accommodations offered in the new motor hotels.

In closing, Brilliant focuses on automobiles and the environment. Conservation efforts, the stifling of mass transit, and the proliferation of parking lots and service stations are cultural testimony to the triumph of the Automobile Age.

Although Brilliant's book suffers somewhat from a lack of comparative data from the Seventies and Eighties, his use of books, newspapers, magazines, memoirs, state documents, and illustrations results in a captivating survey of technological change across a sprawling landscape. *The Great Car Craze* shows how southern California and the automobile grew up in the 1920s, not always harmonious, but inseparable.

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Assistant Curator,
General Americana Section

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YOUR VIEW TO THE WORLD

MUSEUM TRAVEL PROGRAM, 1991

SPICE ISLANDS OF THE INDIAN OCEAN
May 17–June 3, 1991
Sail aboard the 139-passenger expedition ship *World Discoverer* to the remote islands of the Indian Ocean, which are fragrant with spices and rich in unusual flora and fauna. The *Discoverer's* shallow draft and fleet of go-everywhere Zodiac craft permit close exploration of otherwise inaccessible shore lines, rookeries, and islands. Explore Mauritius, Réunion, and the Comoros, and snorkel among the Seychelles. On board are expert naturalists, anthropologists, and scientists who present daily lectures. Visit Mombasa, Zanzibar, and Madagascar, home of a large number of unique species in danger of extinction. You may join an optional post-cruise safari to Kenya's Lake Turkana and Shaba Game Reserve.
From $5,450, plus airfare.

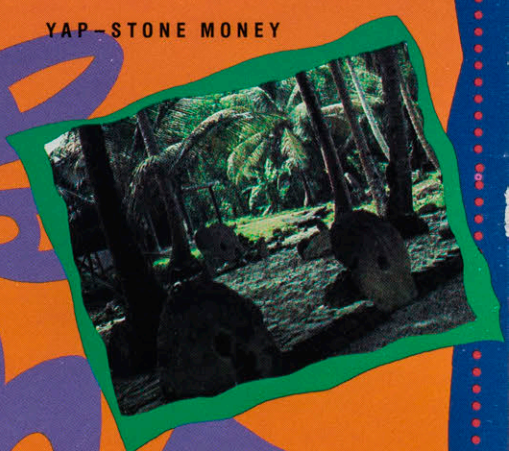
RUSSIA
June 3–16, 1991
This spectacular cultural and historical experience includes visits to the zoos of Moscow and Leningrad, to Askania Nova—the largest game preserve of the Soviet Union, and to special biosphere reserves as well as tours of the Kremlin, Red Square, and the onion-domed cathedrals of other magnificent cities. Visit the enchanting Ukranian city of Kherson and the cultural mecca of Odessa, perched on the edge of the Black Sea. You may extend your visit with an optional stay in Helsinki and a cruise across the Baltic Sea to lovely Stockholm.
$3,925 including airfare

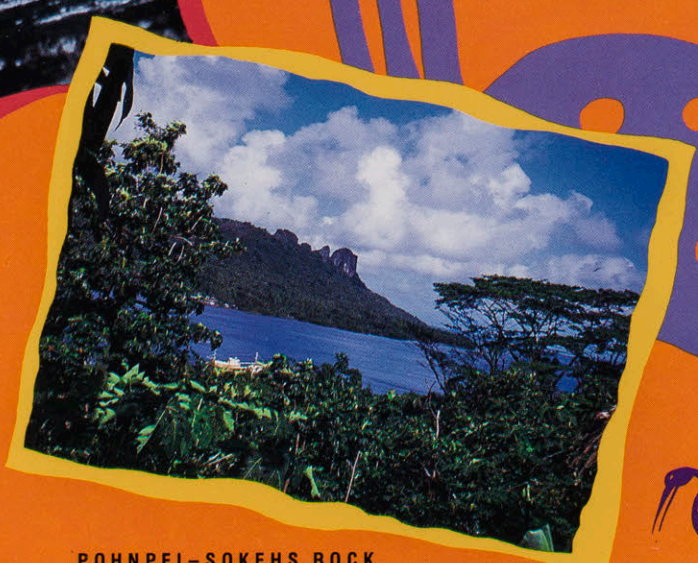
MICRONESIA
June 22–July 6, 1991
Few are familiar with the 2,000 enchanting Pacific Islands that make up Micronesia. Join master basket-maker and anthropologist Judy Mulford on a cultural and natural history tour that begins with a behind-the-scenes visit to the Bishop Museum in Honolulu, Hawaii. Enjoy the lush jungle vegetation of Pohnpei, with its Micronesian Cultural Center and Porakiet Village. Explore Nan Madol, the finest archaeological site in Micronesia. Snorkel in Truk Lagoon, and visit artisans on Fefan Island. See the Latte Mepo Stones on Guam, and view Yap's famous stone money and traditional meeting houses. From Belau, explore the spectacular archipelago of the Rock Islands.
$3,400 approximate cost plus airfare.

NATURAL TREASURES OF ECUADOR
July 18–August 3, 1991
Join us in a naturalist's paradise! Visit La Selva, deep within the Amazon rain forest, and see macaws, toucans, monkeys playing in the trees, and iridescent blue Morpho butterflies. Dugout canoes will take us on hidden waterways even deeper into the rain forest. Journey down the Avenue of the Volcanos to Cotopaxi National Park and explore the slopes of the world's highest active volcano. Cruise through the Galapagos Islands aboard the 20-passenger *Bartolome* for an intimate look at some of the most unusual plant and animal species in the world.
$4,708 including airfare

POHNPEI–UPPER NET WATERFALL

YAP–STONE MONEY





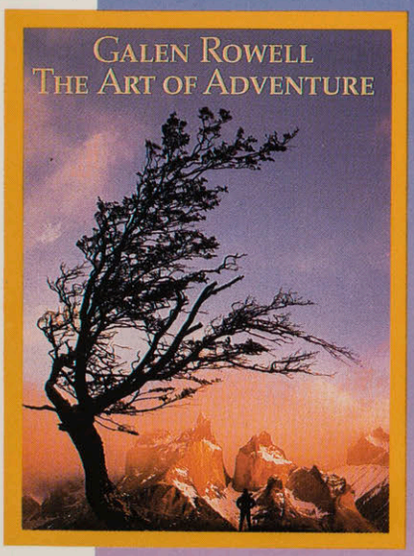
POHNPEI–SOKEHS ROCK

For further information, please contact:

Karen Hovanitz
Museum Travel Program
Natural History Museum
900 Exposition Boulevard
Los Angeles, CA 90007
(213) 744-3350

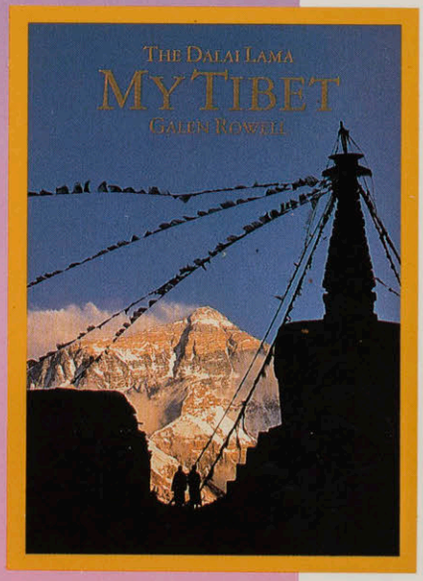
FIND ADVENTURE IN THE MUSEUM BOOKSTORE

In conjunction with the current exhibition, JOHN MUIR: THE YOSEMITE, which features the photography of Galen Rowell, the Museum Bookstore offers three beautiful books of Rowell's photographs. In addition to John Muir's *The Yosemite*, the bookstore has:



The Art of Adventure, a retrospective of Rowell's twenty year around-the-world odyssey. Whether the image is of wild horses thundering across the Patagonian plain or a hungry hyena stalking flamingoes at Ngorongoro Crater in Kenya, Rowell has captured the romance of wilderness and the excitement of adventure travel like no other photographer of his generation.

My Tibet, an unusual collaboration featuring photographs and an introduction by Rowell with a text by His Holiness the Fourteenth Dalai Lama. The combination of the photographs, which express Rowell's own commitment to the natural world, and the Dalai Lama's observations, many of them direct responses to the images, helps preserve the enduring meaning of Tibet's culture, religion and natural heritage.



The Art of Adventure	**$19.95**
My Tibet	**$35.00**
The Yosemite	**$40.00**

THE MUSEUM BOOKSTORE

The Museum Bookstore, located at the North Entrance of the Museum, stocks an extensive selection of nature-related books and gifts. For more information, or to order by phone, call 213-744-3434.

Natural History Museum of Los Angeles County
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